

Botswana Minamata Initial Assessment

National Report

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Foreword

Mercury has been recognized as a chemical of global concern, owing to its long-range atmospheric transport, its persistence in the environment, its ability to bio accumulate in ecosystems and its significant negative effects on human health and the environment.

Botswana ratified the Minamata Convention on Mercury on16 August 2017. The Global Environment Facility (GEF) has made funding available for countries that need assistance in the implementation efforts related to the Minamata Convention, and Botswana is amongst the beneficiaries that obtained funding to undertake a Minamata Initial Assessment Project (MIA). The project's overall aim, being to acquire baseline data on the use and production of mercury in Botswana. To that end a mercury inventory was conducted in April 2019. The inventory will help Botswana to build national capacity around issues related to mercury releases and mercury compounds. The results showed that coal powered stations were the highest emitters of mercury.

As part of Botswana's effort to meet provisions of the Convention, the Ministry of Environment, Natural Resources, Conservation and Tourism, in its capacity as a main policy making agency in the environmental field is responsible for the implementation of the MIA and is a national partner to the UNEP in application of project activities in Botswana. The Minamata Initial Assessment project also assessed the legal and policy frameworks and institutional capacity for implementation of the convention. The MIA recommends strengthening of institutional and administrative capacities for sound management of mercury and its compounds. Additionally, the report recommends promoting intensive awareness raising and education activities, which will give Botswana an opportunity to accomplish the primary objective of the convention which is to protect the environment and human health from adverse effects of mercury.

Finally, on behalf of the government of Botswana, I wish to extend our great appreciation to UNEP and its secretariat for continually supporting developing countries including Botswana through financial and capacity building initiatives in the Environmentally Sound Management of Hazardous Chemicals, that are potentially harmful to the Environment and Public Health.

Honorable Fildah Nani Kereng

Minister of Environment, Natural Resources, Conservation and Tourism

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Botswana received funding from the Global Environment Facility (GEF) to undertake its Minamata Initial Assessment (MIA) so that it could move quickly into implementation based on comprehensive assessment of its sources of mercury. The funds were channelled through the UN Environment as the implementing agency and the Africa Institute as the executing agency. These are the institutions that guided this MIA study in the country. Their guidance is highly appreciated.

The fieldwork was undertaken by a multi-sectoral group of stakeholders. They knocked on many doors persuading a broad range of stakeholder institutions in the country that it is in everyone's interest that they provide their data so that it makes its way into this report. Their efforts are highly appreciated. Since many of them came from these stakeholder institutions they have learned first-hand that this was just the beginning more and tougher work lies ahead.

The Department of Waste Management and Pollution Control (DWMPC) must continue to be a torch and flag bearer on this topic so that Botswana could transit into implementation quickly. Its coordinating role is invaluable. Many other line ministries and departments must coalesce around this department so that an impactful footprint could be achieved within the shortest possible time. It is when they coalesce around this department and this collective objective that they will leverage on each other's strength in the national interest.

Other players including consultants, private sector, tertiary institutions, NGOs and the community at large who provided input into this undertaking are highly thanked. It was always a team effort.

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Acronyms

ASGM	Artisanal Small Gold Mines
BAT	Best Applicable Technology
BEP	Best Environmental Practice
BITRI	Botswana Institute of Technology Research and Innovation
BODEA	Botswana Dental Association
BOCONGO	Botswana Council of Non-governmental Organisation
BOCONET	Botswana Community Based Non-governmental Organisation
BOCRA	Botswana Communication Regulatory Authority
BTV	Botswana Television
BURS	Botswana Unified Revenue Services
CIEN	Chemical Information Exchange Network
CMS	Central Medical Stores
COP	Conference of Parties
DHMT	District Health Management Teams
DOM	Department of Mines
DOHS	Department of Occupational Health and Safety
DEA	Department of Environmental Affairs
DWMPC	Department of Waste Management and Pollution Control
DRTS	Department of Transport Road and Safety
EEE	Electrical and Electronic Equipment
GEF	Global Environmental Fund
ICT	Information Communication Telecommunication
IEC	Information Education Communication
MAFS	Ministry of Agriculture and Food Security
MEACC	Multilateral Environmental Agreements Coordinating Committee
MENCT	Ministry of Environment Natural Resources, Conservation and Tourism

MTI	Ministry of Trade and Industry
MIA	Multilateral Environmental Agreements
MENRCT Tourism	Ministry of Environment, Natural Resources Conservation and
MBE	Ministry of Basic Education
MAFS	Ministry of Agriculture, Food and Security
MOH	Ministry of Health and Wellness
MLGRD	Ministry of Local Government and Rural Development
MYSC	Ministry of Youth Sports and Culture
NAP	National Action Plan
NEF	National Environmental Fund
NGO	Non-governmental Organisation
NDP	National Development Plan
PDE	Polybrominated Diphenyl Ethers
PCB	Polychlorinated Biphenyl's
PPE	Personal Protective Equipment
SADC	Southern Africa Development Cooperation
SAPP	Southern Africa Power Pool
SDG	Sustainable Development Goals
UNEP	United Nations Environmental Programme
VDC	Village Development Committee

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Executive Summary

Exposure to mercury poses a serious risk to the environment and human health worldwide. It can cause a range of serious health problems which may include cognitive impairment which may manifest itself as mild mental retardation, poor performance in school and delinquency, permanent damage to the central nervous system, kidney and heart disease, infertility, and respiratory, digestive, and immune problems. These are broad and significant health problems that no society can just brush aside. The World Health Organisation (WHO) strongly advises that pregnant women, infants, and children in particular avoid exposure to excess mercury because of their heightened vulnerability.

Mercury is ubiquitous in society. It is found in homes, businesses, buildings, environment, water, land, air, measuring devices, food, schools, lighting devices, healthcare systems, etc. It is everywhere. As a way of addressing it, the international community has come together to establish the Minamata Convention on Mercury. This is a legally binding global instrument aimed at protecting human health and environment from the adverse effects of mercury. It entered into force on 16th August 2017 after securing the ratification of the 50th Party. Since coming into force, countries that are Parties to the Convention are now legally bound to fulfil a range of mandatory measures such as banning new mercury mines, phasing down and phasing out mercury-added products, including thermometers, batteries, light bulbs, switches, skin lightening creams and soaps, and regulating the use of mercury in artisanal and small-scale gold mining (ASGM). The Convention outlines a life-cycle approach to the supply, trade, use, emission, release, handling, and disposal of mercury. It also includes articles that are related to the exchange of scientific, technical, economic, and legal information concerning mercury and mercury compounds, as well as measures to evaluate its effectiveness.

Some provisions of the Convention are obligatory such as those that use the term “shall” while others are voluntary, using terms such as “may”. Successful implementation of the Minamata Convention in Botswana will be a difficult task in the absence of a balanced interface among research, policy, and economy as indicated in this MIA. Foremost, mercury management action plans need to be developed for selected industries largely responsible for mercury emissions and releases along with a national roadmap that facilitates the development of detailed plans including sectoral and private sector plans. This MIA focusses mainly on the role that will be led by the government but provides entry points for other actors to join in so that comprehensive mitigation can be achieved.

From the legal front, it is observed that Botswana must develop a comprehensive chemicals framework law. This law will provide coordination among the many sectoral pieces of legislations that are implemented by many government departments, private sector, and NGO entities. Botswana must maintain the institutional coordination capacity that it has developed during this MIA process so that it will leverage on it for Minamata convention implementation as well. This may also be extended into the implementation of the other 3 related MEAs (Basel, Rotterdam and Stockholm conventions). This multi-stakeholder coordinating structure may be given legal status so that it has stronger legal impact. It must be mainstreamed and provided with resources. Without resources it will suffer the same fate as the coordination structures that were developed when the national implementation plan for the Stockholm convention was developed which died after the process was completed.

From the inventories, it appears that while most of the mining in Botswana is about diamond mining, the limited gold mining that takes place in Mupane remains a concern as it produces the largest amount of mercury released to land, water and air. The second largest area of concern for the country is mercury added products. This has a broad range of products that are listed in the Minamata convention under Annex A. They range from mercury containing batteries to cosmetics

and lighting devices. It is important for Botswana as a Party to note the phaseout date of 2020 as provided in this Annex for these mercury-added products. Since the convention is now in force, it is an obligation of the Parties to abide by the phaseout dates as provided. Mercury in dental amalgams is a concern also and given the fact that there are alternatives in the market, the government of Botswana might consider legislating for transition in line with the guidance provided in Annex A Part II of the Minamata convention.

The issue of mercury use in religious and cultural activities in Botswana does not come out clearly in this MIA. This is because there is no conclusive data from the field. Batswana have remarkably similar cultural practices to other ethnic groups in the region who use mercury. It is therefore probable that while the data is not conclusive the practices occur in Botswana as well. Whether these practices are happening in Botswana can only be proved by a detailed study that the government must consider in the future. This problem of mercury in cultural practices is a major source of concern in other neighboring countries since it is also used by pregnant women which exposes the unborn fetus to mercury even before birth. This practice is in stark contrast to the guidance given by WHO on mercury exposure which advises that pregnant women, infants and children should not be exposed to mercury because of their vulnerability.

The other issue of concern is waste management including wastewater. This is the second significant most release of mercury into water in the country. Botswana is a dry country and pollution of its water resources with mercury should be a source of concern. Given the shortage of water, it is remarkably easy for mercury in the water to find its way back into the human population. Equally, the mercury will very easily be ingested by animals as they drink water and find its way back into the human population when they consume such animals.

On the awareness front, it has been indicated that part of the challenge with messaging arises from the reliance on English language as a medium of communication especially in government circles. Many environmental conventions including Minamata convention are scientific and technical in nature challenging the vocabulary of local languages. Although this challenge exists all efforts must be made to message the conventions in the local language to the extent possible so that the most potentially vulnerable populations can also obtain the requisite awareness. Linguists must be brought in so that they can help the scientists to package the messaging in a manner that will not dilute its content to those who can only comprehend it in the local languages.

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Chapter 1: Introduction

This report is about a global response to mercury as a pollutant of international concern with many impacts on both the environment and human health. Mercury is a naturally occurring element that is found in the air, water, and soil. It exists in several forms, such as, elemental, or metallic mercury, inorganic mercury compounds, and organic mercury compounds. It is rarely found in nature as the pure, liquid metal, but rather within compounds and inorganic salts. It volatilizes readily forming vapours that are colourless and odourless. As the temperature increases, it forms more vapours which are released into the atmosphere.

It has traditionally been used to make products like thermometers, switches, and some light bulbs. It is also used in some cultural and religious activities. It is a common addition in the dental amalgams and continues to be used openly in artisanal small-scale gold mining (ASGM) especially in the developing countries. Many African countries are blessed with gold and in almost all of them artisanal small-scale gold mining is a key livelihood activity.

In Botswana there is very little-known gold mining taking place within its territory with some limited operations in Mupane. Most of the mining is diamond mining. Nevertheless, Batswana have always participated in the South African gold mining industry. As such, Botswana is exposed to ASGM activities that are taking place in neighboring South Africa. South Africa has a long history of gold mining in its Gauteng and Free State provinces. For almost a century it has relied on the migrant labor system of able-bodied men from the neighboring small countries such as Botswana, Swaziland, Lesotho, Malawi, Zimbabwe and Mozambique who served as the labor reserve for its burgeoning gold mining industry.

Over the years some of these old mines have been decommissioned because of low productivity. As they became abandoned, they were then invaded by the retrenched miners, many with good mining experience but rendered jobless as more and more mines were closed. Also, with the high unemployment in the region, many young men have ventured into this activity in order to earn a living. Many of these illegal miners come from the same neighboring countries such as Botswana that supply cheap mining labor to South Africa. Because they are no longer in the formal mining sector, they use crude mining methods that are consistent with the artisanal small-scale gold mining in which mercury is used.

Generally, the boundaries are porous between these countries and therefore cross-border movement is easily achieved even without the right documentation. Therefore, these miners work in these mines as undocumented workers and return home to bring remittances of their illegal enterprise. When they get sick or if they get sick, they also return home to be cared for by their families and the national healthcare system of their countries of birth. But because their mining activities are considered illegal in both their countries of origin and South Africa, they remain outside the purview of governments without being recognised as victims of mining operations.

Mercury is found in many rocks including coal and Botswana depends on coal for its power supply. When coal is burned, mercury is released into the environment. Other activities that release mercury include burning wastes, breaking mercury products, and spilling mercury as well as the improper treatment and disposal of products or wastes containing mercury. Open burning of mixed waste is a very common phenomenon in Botswana being practiced by most households as well as the municipalities or town councils. Thus, waste management is a significant source of mercury in Botswana as well given this practice.

Mercury exposure at high levels can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. It has been demonstrated that high levels of methylmercury for example in the bloodstream of unborn babies and young children may harm the developing nervous system, making the child less able to think and learn. Mercury also causes increased cancer risk of the liver and of the oesophagus. Respiratory toxicity may also cause pulmonary edema, congestion, coughing, interstitial pneumonitis, and respiratory failure. Mercury may also affect reproduction by causing increased spontaneous abortions, congenital anomalies, and reduced fertility among women.

In 2005 the UNEP Governing Council requested the Executive Director of UNEP to urge governments, intergovernmental organizations, non-governmental organizations and the private sector to develop and implement partnerships in a clear, transparent, and accountable manner as one approach to reducing the risks to human health and the environment from the releases and emissions of mercury and its compounds.

Building on this decision UNEP invited governments, particularly in developing countries and countries with economies in transition, to identify, in consultation with stakeholders, priority partnership areas as soon as possible and to work with governments and relevant stakeholders to compile and report needs identified to execute the partnerships and assist in the mobilization of resources in support of the partnerships.

To this end, a global assessment report under the tutelage of UNEP was prepared on mercury and mercury compounds with the objective of promoting environmentally sound management of mercury and its compounds as well as contributing to an obvious awareness gap that was evident about this substance.

The Minamata Initial Assessment (MIA) process is an enabling activity which is financed by the Global Environment Facility (GEF). While GEF has a long history of supporting initiatives that reduce the contamination by mercury dating as far back as the 1990s, its involvement in the Minamata Convention has been specifically included in Article 13 of the Convention as one of the predictable financial mechanisms that should be made available to developing countries and countries with economies in transition in particular towards the early ratification and implementation of the Minamata Convention.

In June 2013, the 44th GEF Council approved an allocation of $10 million towards assisting prospective parties to Minamata convention in the developing countries and countries with economies in transition in their Minamata pre-ratification initiatives. Furthermore, the Conference of Plenipotentiaries on the Minamata Convention on mercury in 2013 invited the GEF Council to support developing countries and countries with economies in transition that are signatories to the Convention in undertaking activities, particularly enabling activities, to facilitate early implementation and ratification of the Convention.

In May 2014, the GEF instrument was amended to include the Minamata Convention. As a result, from July 2014 to June 2018, GEF has allocated $141 million towards Mercury projects around the world. This allocation has enabled many countries to undertake their MIA processes to facilitate their ratification of the Minamata Convention. This was probably one of the most significant contributors to the successful coming into force of the Minamata Convention upon attaining the required 50th ratification in 2017 as many countries were able to do their initial assessments to assist them in the decision-making process.

Thus the Minamata Convention is a culmination of the negotiation process that began in 2009 and ended in 2013 at Intergovernmental Negotiating Committee (INC) 5 when governments participating in the INC process agreed on the text of a globally binding instrument which has formed the Minamata Convention. This was signed by delegates from 140 countries on the 19*th* January 2013 in Kumamoto, Japan. The Convention is named after the Japanese City of Minamata.

This naming is of symbolic importance as the city went through devastating incident of Mercury poisoning. It is expected that over the next few decades, this legally binding international instrument will enhance the reduction of mercury pollution from the targeted activities responsible for the major releases and emissions of mercury to the environment. The convention is the latest in the series of chemicals and chemicals waste conventions following the Stockholm Convention on persistent Organic Pollutants (POPS) that was adopted in 2001 and the Basel Convention which deals with the control of transboundary movement of hazardous wastes and other wastes.

The Minamata Convention came into force on the 16th of August 2017 after it had received its 50th ratification. Botswana ratified the convention on the 3rd of June 2016. As part of enabling activities to assist countries to implement the Convention, The United Nations Environment (UN Environment) through the Global Environment Facility (GEF) Trust Fund has availed funds to a regional Project undertaken by four Countries, namely Botswana, Lesotho, Namibia and Swaziland, executed by the Africa Institute. The Africa institute is an Inter-Governmental Organization established primarily to serve the 23 Anglophone African Countries on matters of chemicals and hazardous waste management and has been working with the countries in the Minamata development process as well. In Botswana, the project is undertaken by the Ministry of Environment, Natural Resources Conversation and Tourism through the Department of Waste Management and Pollution Control (DWMPC).

Component	**Output**
• Component 1: Establishment of Coordination Mechanism and organization of process	National coordination
• Component 2: Assessment of the national infrastructure and capacity for the management of Mercury, including national legislation	Legal and institutional Report
• Component 3: Development of a Mercury inventory using the UNEP Mercury tool kit and strategies to identify and assess Mercury contaminated sites	Inventory Report using Level 2
• Component 4: Identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury	Needs and Opportunities Report
• Component 5: Preparation and validation of National MIA reports and implementation of awareness raising activities and dissemination of results	Consolidated MIA Report and its validation
• Component 6: Information exchange, capacity building and knowledge generation	Dissemination and capacity building

The purpose of the MIA projects is to help recipient countries to develop baseline data that they could use to understand the national situation and therefore justify their ratification based on such and further assist with priorities towards early implementation of the Minamata Convention. The project also recognises that mercury affects multi-sectoral stakeholders who need to coordinate their efforts if any meaningful gains must be made at the national level. It is

found in trade, health, science, culture, social use, domestic emissions, food, waste management, water and many areas that affect ordinary day to day activities in all countries.

It therefore requires industry, government, municipalities, civil society organizations, schools, academia, hospitals, doctors, sociocultural leaders, media, ordinary people and many other actors to work together. It is for this reason that one of the most important components of the MIA process is component 1 which organizes coordination. A country may take opportunity provided by the MIA process to further synchronise its chemicals conventions coordination since there is always an overlap and synergy in these conventions.

Component 2 of the project requires a country to evaluate its institutional setup and the legal foundation for effective implementation of the Minamata Convention. The key issue here is for a country to align its institutional setup such that the obligations of the convention will be implemented seamlessly and without difficulties. It is against this backdrop that this evaluation also included evaluation of the legal requirements that will assist in that endeavour.

Component 3 requires a country to document its mercury sources and the magnitude of the releases and emissions emanating thereof. This is important as it speaks to the extent of exposure that the country is experiencing. To standardize the Mercury inventory process across the world, UNEP contracted a Danish consulting company called COWI to develop a spreadsheet-based toolkit that is used to calculate Mercury from the various sources based on the quantities of the materials in question. This toolkit is an indirect but most cost-effective method available for calculation of Mercury emissions and releases from various substrates and processes. It is a simplified method that bridges the scientific gap and hurdle that most countries are facing especially developing countries.

This toolkit has 2 levels: Level 1 is the most basic with calculations depending on in-built formulas without user influence. Level 2 is advanced and requires detailed inputs for the toolkit to calculate the mercury emissions and releases in a more accurate manner. This allows the user to provide specific conditions that may be characteristic of the national or sub-regional scenario so that the mercury emissions and releases are more accurate. This requires considerable baseline information that most developing countries, especially African countries may not always have. Nonetheless to reflect better the mercury situation even in these countries it remains advisable to attempt Level 2 inventories using whatever scientific data may be available regardless of its inadequacy.

Component 4 analyses the needs of a country so that it could implement the Minamata Convention. This component also outlines the already existent opportunities that a country may capitalise on as it moves into the implementation of the Minamata Convention. The logic in this is that while countries may need assistance to address the challenges that they face to reduce or eliminate the Mercury threat, they invariably have endogenous options that they already possess that could assist them to achieve this goal.

These opportunities may be institutional, financial, technical, good-will and otherwise in nature and the countries must then systematically harness them so that they could expedite the implementation of the Minamata Convention for the benefit of their populations and the environment. The purpose of implementing the Minamata Convention is not merely to become complaint with the obligations of the convention as a Party but primarily to protect the people and the environment in each of the Parties.

Component 5 synthesizes all the information so that a consolidated report is produced. This component further requires each participating country to launch and educational and outreach campaign so that people are sensitised to the dangers and possible exposure to Mercury.

Knowledge is power. When people know then they are more likely to take necessary precautionary measures to reduce their exposure and therefore minimize harm on themselves.

The effects of Mercury on humans are big and debilitating and, in some cases, leading to loss of life. It is therefore an unavoidable obligation on the part of the government and civil society organizations to transfer all essential information to the populations at risk using all methods necessary. Failure to do so may be a human rights issue.

Component 6 requires a country to exchange all the information that it has within its territory and with the target groups and with all other agencies that may have a stake in this matter. It also requires countries to share their results with others so that their situation may be well understood, and a regional scenario may be revealed. Under this component countries will also share lessons learned through the MIA process especially those that are within the same region.

Botswana acceded to the Minamata Convention on the 3rd June 2016. The convention entered into force on the 16th August 2017 and as of February 2020, it had 118 Parties. It held its first Conference of the Parties (COP 1) on 24 – 29 September 2017, COP 2 was held 19 – 23 November 2018 and COP 3 was held 25 – 29 November 2019 in Geneva Switzerland.

Chapter 2: The country background

2.1 Geographic setting

Botswana is a landlocked country covering an area of 582, 000 km^2, with a population of 2, 025, 900 people according to the 2011 Population and Housing Census. Drought is a recurrent phenomenon, and most rivers are seasonal; hence, water is a scarce resource. The population is concentrated in the eastern parts of the country where arable farming is feasible on account of better and more favourable climatic and soil conditions. Botswana shares borders with Angola, Zimbabwe, South Africa, Namibia and Zambia (Fig. 1).

Botswana has a mean altitude of around 1, 000 metres above sea level (m.a.s.l.). Gazetted forest reserves cover 4, 555 km^2 and cover 0.8 % of the total land area. Much of the country is flat, with gentle undulations and occasional rocky outcrops. Vegetation consists mainly of savanna species such as *Chloris virgate*, *Setaria verticillate*, *Tragus berteronianus* and perennial grass species such as *Cenchrus ciliaris*, *Enneapogon cenchroides*, *Eragrostis rigidior* and *Panicum maximum*. Indigenous trees include *Colophospermum mopane* (mophane), *Vachellia erioloba* still more commonly known as *Acacia erioloba* (camel thorn) and *Adansonia digitata* (baobab).

The hills and deep valleys of the eastern portion contain the highest and lowest points, ranging from 1, 489 m.a.s.l. at the *Tsodilo* Hills to 513 m.a.s.l. at the Limpopo and *Shashe* rivers. The Okavango, one of the southern Africa longest rivers, flows through north western Botswana, fanning out into a huge delta some 15, 000km^2 in extent. In the central north-east there is a large area of calcrete plains bordering the Makgadikgadi pans. The rest of the country is covered with thick sand layers of the Kgalagadi (Kalahari) desert, occupying about 84 % of the land area and supporting shrub and grass vegetation.

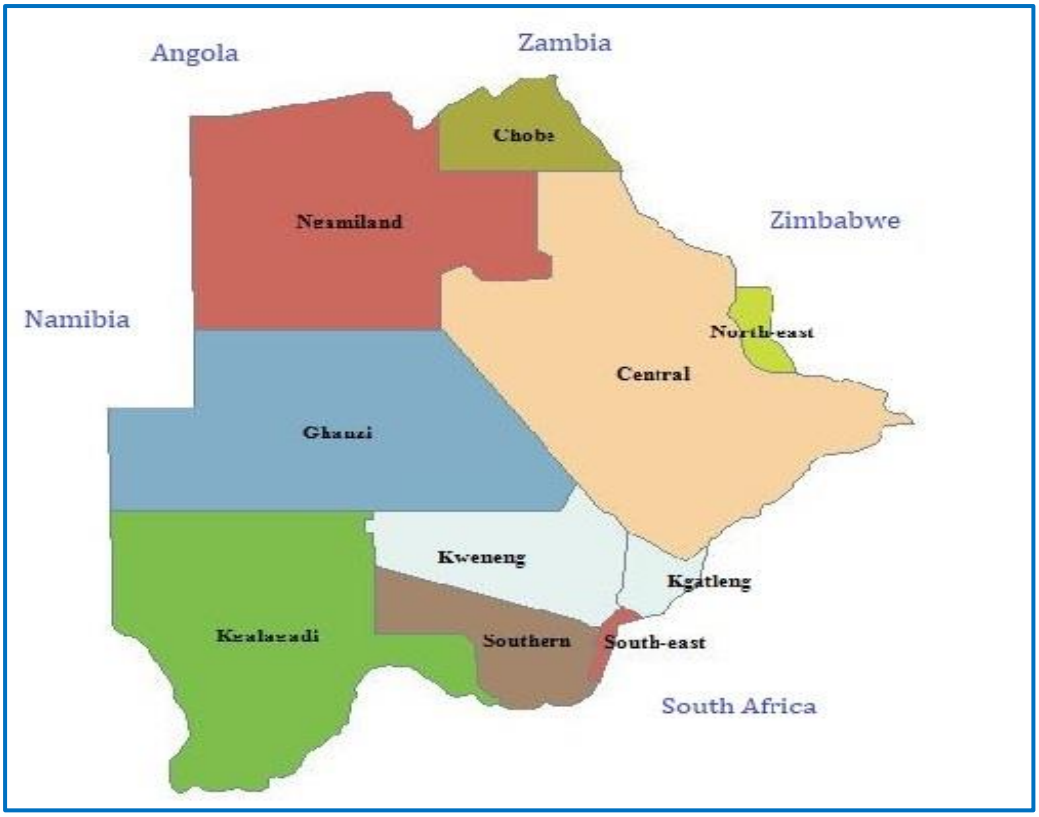


Figure 1: Botswana's political administrative districts

2.2 Weather and Climate

Situated close to the subtropical high-pressure belt of the southern hemisphere, Botswana has a dry, semi-arid climate. Rainfall is seasonal, with uneven distribution. Most rivers flow seasonally, except in the Northwest District where the major rivers are perennial. Ground water exists at varying depths in most parts of the country.

The mean annual rainfall of 450 millimetres (mm) ranges from 250 mm in the south-west to 650 mm in the north-east. The main rainy season occurs between November and April, with significant variations from year to year and severe drought in many cases. Generally, annual evaporation and transpiration are high, with the result that agriculture without irrigation is only viable for approximately six months.

The highest mean monthly temperatures range between 32 to 35 ^{0}C and generally recorded in the months of October and January. The lowest monthly temperatures are between 1 and 5 ^{0}C over the southern and eastern parts of the country, and 5 and 7 ^{0}C in the northern parts of the country.

Even though the northern two-thirds of the country lies within the tropics, the climate is more temperate than tropical due to land altitude and distance from the sea. Temperatures are high in summer, while winter days are mild, winter nights often see temperatures reaching below zero in most parts of the country.

2.3 Soils

Soil create geographical differences in plant and animal life due to climate. In terms of the major soil groups, about two thirds of the country is covered by sandy soils which are infertile. These are the red and grey desert soils of the Kalagadi Desert. Influenced by the soils and rainfall, the following types of vegetation cover the country, grassland, natural woodland, forestland, savanna, bushland, aquatic and man-made plantations. Vegetable resources play important role in livestock farming and wildlife industries, and thus contribute to the national economy and the wellbeing of its citizens. That is why sustainable land use practices are necessary to avoid, amongst others, land degradation, over-grazing, loss of biodiversity and the degradation of the environmental resource base.

2.4 Population

Botswana's population has increased over the years, from 574, 000 in 1971 to 2, 025, 900 in 2011. The annual population growth rate between 2001 and 2011 was 1.9 percent. The rapid growth from 1971 to 1991 was the result of the country's high birth rate and declining mortality rates, which were due to the improved health of the population. In 2019, the population growth rate was 2.2 per annum.

The vast majority of Batswana reside in the more fertile eastern regions where water and land resources are better. The Central District continues to command the biggest percentage share of the population (28 percent), which is 2 percentage points higher than the 2001 figure. The districts of Kweneng (15 percent), Ngamiland East (5 percent) and South East (5 Percent) increased in their share of the national population by 1 percent. This emerging pattern may be due to the housing shortage, which has seen people moving from cities and towns to urbanised villages.

Some of the contributory factors on the decline side are HIV/AIDS, declining fertility rates, increased literacy rates, and access to better healthcare including family planning. Despite the continuing decline in the population growth rate and the total fertility rate, the population of Botswana will continue to grow for some years to come, largely due to its youthfulness.

The age and gender composition of the country is weighted by an increasingly youthful population. Approximately one-third are younger than 15, and another one-third are between the ages of between 15 and 29. The 2001 census showed life expectancy of 49.6 years at birth for females and 51.6 years for males, compared with the 1981 figures of 61.2 and 54.7 years respectively. In 2019, the average life expectancy has increased to 69 years probably indicative of the successes achieved in the treatment of HIV/AIDS pandemic and the remarkable economic growth from a least developed country to a middle-income country in recent years.

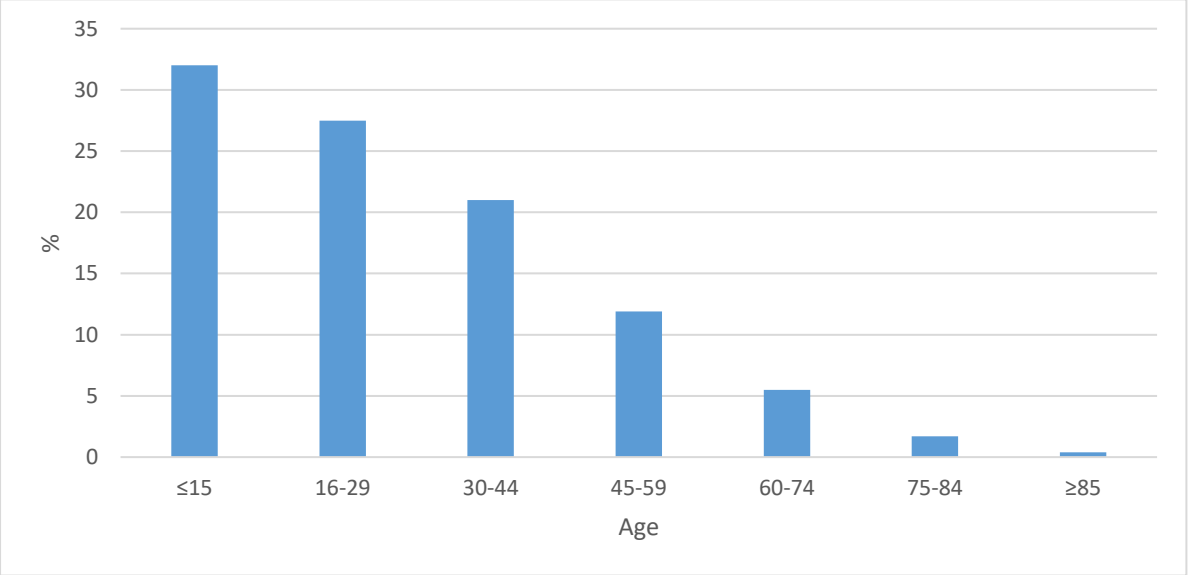


Figure 2: Age groups of the Botswana population in 2017

2.5 Economy

Botswana is a free market economy with a strong traditional central government planning to provide infrastructure for private investment. The economy has grown rapidly since the mid-1960's, with a gross domestic product per capita increasing more than hundred-fold.

Botswana is a country rich in a variety of mineral resources with diamonds being the most significant resource since their discovery. Unexploited resources such as gypsum, iron, asbestos, feldspar, chromium, graphite and manganese are in the remote areas below the Kalahari sands. The mining sector, and diamond mining in particular, is the major contributor to the export base, and government policy endeavours to reduce the vulnerability arising from the heavy dependence on diamonds.

Botswana enjoys a Gross National Income (GNI) of $6, 890 per capita. This is a far cry from 45 years ago, when the Gross Domestic Product (GDP) per capita was just US$70. At independence in 1966, agriculture made up about 43 percent of the economy while banks, insurance and other business services contributed some 20 percent. Presently, while mining continues to be the

substantial revenue-earner, making about a quarter of Botswana's total GDP. Other sectors such as financial services, construction, and tourism have steadily increased their output. Smaller contributors from the base metals are copper, nickel, and cobalt and also, coal, soda ash and gold. 80% of the mining manpower is employed in the two mining companies of Debswana.

Given the county's extensive coal resources and projected regional power demand, Botswana has the potential to develop and support a small-scale coal-bed methane industry and additional coal-fuelled electricity-generating plants that could supply power to the Southern African Power Pool (SAPP) through its land lines to South Africa.

2.6 Agriculture

Agricultural output constitutes less than one-tenth of the gross national product and most of that is in the form of livestock production and export markets. Grain production (mostly sorghum, millet, and maize) fell short of the national consumption for most of the 20th century, and foodstuffs from South Africa and Zimbabwe are some of Botswana's major import commodities. Fishing and forestry production are limited and largely confined to the extreme north.

The beef industry plays a pivotal role in the country's economy. It is one of the leading in exports and sources of foreign exchange for the country. In 1973, meat, hide, and skins were the leading export commodity with an export share of 55%. Botswana has 2,5 million cattle, 80 percent of it in communal farms.

The beef industry contributes about 80 % of agriculture's share of Gross Domestic Product (GDP). Beef processing accounts for about 80 % of the livestock industry, and over 95 % of beef production is exported. However, it should be noted that agriculture in general has declined from 43 percent of the economy to less than 5 percent due to severe and prolonged droughts and change in climate patterns.

2.7 Tourism

Tourism is the secondary earner of foreign exchange and many Batswana are engaged in tourism-related services. Tourism continues to play an increasingly significant role in the diversification of the economy. In 2018, Botswana's tourism sector supported 84, 000 jobs or 8.9%of the country's total employment. Tourism has been and continues to be one of Botswana's fundamental economic sectors, having contributed greatly to government revenue and boosted important macro business.

Botswana's principle tourist attractions are its game reserves with hunting and photographic safaris. Other attractions include the Okavango Delta region which during the rainy season is a maze of waterways, islands, and lakes. The tourism industry also helped to diversify Botswana's economy from traditional sources such as diamonds and beef.

Botswana's impressive economic performance over the past four decades is mainly due to the success of its export sector.

2.8 Poverty

Poverty remains a serious social challenge for the country with approximately 16 percent of the approximately 2 million population living below poverty line. Botswana has one of the world's highest recorded Gini co-efficient for disposable income at 0.645 and 0.495 for consumption.

Though Botswana is not a technically poor country, substantial clusters of poverty remain in its rural areas. In some rural areas, the poverty rate is as high as 46%.

2.9 Unemployment

Available data show that employment figures increased from 317, 827 in 2009 to 341, 115 in 2015, representing a growth rate of 1.2 percent per annum. As a result of the slow growth of employment opportunities. The unemployment rate is currently estimated at 20%. The youth and women are the most affected. According to the 2011 Population and Housing Census, the employment rates for the youth of both sexes were 10.36% for 15-19 years, 29.93% for 20-29 years and 24. 76% for the 25-29 years categories. This gives an approximate average of 27% for the youth of employable age (20 – 29 years of age).

2.10 Gender

The attention of gender balancing and advancement of women has improved since 1995 in Government policies. The different government departments have since started to include the National Women's Machinery in the development of their policies to ensure that a gender perspective permeates their policies. However, women and female headed households suffer poverty and economic marginalisation more acutely than men and male headed households in Botswana. This partly emanated from the culture of Botswana that for so long promoted men as decision makers, leaders and from some laws that discriminated against women.

Although many efforts are being made to push for gender equality in Africa, the reality on the ground indicates that the continent still has a long way to go to achieve this goal. Laws are being amended and new laws are being enacted to address the status of women yet the central challenge that carries this behaviour forward is the cultural repertoire that subordinates women within these countries. Generally, women are regarded as minors whose existence within the families is tightly woven onto the male figures in their families. Major decisions within the families remain the prerogative of the males with women primarily playing a support role. This status of women in most African countries including Botswana is so prevalent that it defines the fabric of society and is ambivalently accepted by both men and women alike.

It continues to be handed down from one generation to the other and manifests itself privately and socially with its natural habitat as the household. Whether advertently or inadvertently the elders in a household enculturate their young into this belief system, and those also grow up to become adults that continue with the practice in their households and then pass it on to their children as well. From the household, it then radiates to the community and then the country. It is a social construct that represents a people's reservoir of what defines them and represents their existential connection to their land and their country. It is a deeply exercised practice that seems to be accepted as a given even against a tide of legal instruments that are meant to change it.

Rural women in particular face the greatest challenge given the conditions within which they live. For many of them educational levels are low, necessities such as water are lacking, healthcare facilities are difficult to access, and incomes are largely non-existent with many depended on males within the families and subsistence agriculture. It is the men who leave homes in search of job opportunities elsewhere while women remain with the children. Men are therefore seen as providers commanding levers of household and community economy while women are caregivers. This puts men at a higher level than women, a position of privileges and power.

Chapter 3: Mercury inventory and Identification of Sources

3.1 Understanding mercury

Mercury is mined as mercuric sulphide (cinnabar ore). Through history, deposits of cinnabar have been the source ores for commercial mining of metallic mercury. After mining, the metallic form is refined from mercuric sulphide ore by heating the ore to temperatures above 540 º C. This vaporises the mercury in the ore and the vapours are then captured and cooled to form the liquid metal mercury. Inorganic mercuric compounds include mercuric sulphide (HgS), mercuric oxide (HgO) and mercuric chloride ($HgCl_2$). These mercury compounds are also commonly called "mercury salts." Most inorganic mercury compounds are white powders or crystals except for mercuric sulphide, which is red and turns black after exposure to light.

Some mercury salts are sufficiently volatile to exist as atmospheric gases. However, the water solubility and chemical reactivity of these inorganic or divalent mercury gases lead to much more rapid deposition from the atmosphere than for elemental mercury. This results in significantly shorter atmospheric lifetimes for these divalent mercury gases than for the elemental mercury gas.

When mercury combines with carbon, the compounds formed are called "organic" mercury compounds or organomercurials. There is a potentially large number of organic mercury compounds such as dimethylmercury, phenylmercury, ethylmercury and methylmercury; however, by far the most common organic mercury compound in the environment is methylmercury. Like the inorganic mercury compounds, both methylmercury and phenylmercury exist as "salts" such as methylmercuric chloride or phenylmercuric acetate. When pure, most forms of methylmercury and phenylmercury are white crystalline solids. Dimethylmercury, however, is a colourless liquid. Some micro-organisms and natural processes can change the mercury in the environment from one form to another.

Methylmercury is of concern because it can build up (bioaccumulate and biomagnify) in many edible freshwater and saltwater fish and marine mammals to levels that are many thousands of times greater than levels in the surrounding water. Methylmercury can be formed in the environment by microbial metabolism (biotic processes), such as by certain bacteria and by chemical processes that do not involve living organisms (abiotic processes). Nevertheless, it is generally believed that its formation in nature is predominantly due to biotic processes.

Of concern to countries such as Botswana where municipal waste in mixed is the fact that methylmercury can be released directly from municipal waste at the landfills and dumpsites and sewage treatment facilities. Being an element, mercury cannot be broken down or degraded into harmless substances. Mercury may change between different states and species in its cycle, but its simplest form is elemental mercury, which itself is harmful to humans and the environment. Once mercury has been liberated from either ores or from fossil fuel and mineral deposits hidden in the earth's crust and released into the biosphere, it can be highly mobile, cycling between the earth's surface and the atmosphere. The earth's surface soils, water bodies and bottom sediments are the primary biospheric sinks for mercury.

In the past, several organic mercury compounds were used quite broadly, for example in pesticides such as extensive use in seed dressing among others and biocides in some paints, pharmaceuticals

and cosmetics. While many of these uses have diminished in some parts of the world, organic mercury compounds are still used for several purposes. Some examples are the use of seed dressing with mercury compounds in some countries, use of dimethylmercury in small amounts as a reference standard for some chemical tests, and thimerosal which contains ethylmercury which is used as a preservative in some vaccines and other medical and cosmetic products since the 1930's.

3.2 Release of Mercury into the Environment

Mercury occurs naturally and can be released to the environment from natural processes such as weathering of mercury-containing rocks, forest fires, volcanic activity, or geothermal activities. It can also be released from anthropogenic sources. There are three types of anthropogenic mercury releases, and these are:

- Releases from mobilization of mercury impurities in raw materials such as fossil fuels (particularly coal), and to a lesser extent gas, oil and other minerals.
- Releases from mercury use intentionally in products and processes, due to releases during manufacturing, leaks, disposal or incineration of spent products; and
- Re-mobilization of historic anthropogenic mercury releases previously deposited in soils, sediments, water bodies, landfills and mine tailings.

From these three different types of releases, there are many products and processes which can release mercury into the environment. The different types of products and processes which can release mercury into the environment have been divided into ten distinct source categories, listed below:

a. Extraction and use of fuels / energy sources
b. Primary (virgin) metal production
c. Production of other minerals and materials with mercury impurities
d. Intentional use of mercury in industrial processes
e. Consumer products with intentional use of mercury
f. Other intentional products / process uses
g. Production of recycled metals ("secondary" metal production)
h. Waste incineration
i. Waste deposition / landfilling and wastewater treatment
j. Crematoria and cemeteries

These source categories are further sub-divided into subcategories, giving a total of 53 subcategories of processes / products that can release mercury into the environment. The subcategories are listed in Table 3.1 under Section 3.3. One of the main reasons for carrying out a mercury inventory is to contribute to informed decision-making regarding mitigating the environmental effects of mercury. Since the inventory is meant to identify the most significant mercury release which can be controlled, it therefore follows that the inventory will only target anthropogenic sources, as they are the ones that can be controlled relatively easily.

3.3 Quantification of Mercury Releases

A mercury inventory is best conducted using the UNEP Toolkit for Identification and Quantification of Mercury Releases (UNEP, 2017). This Toolkit offers two different levels under which the inventory

can be conducted (based on simplicity). Level 1 is a simplified and more standardized methodology, while Level 2 is more detailed and gives one the opportunity to use factors which are site-specific and not generalized.

The Toolkit employs a lifecycle approach, which assumes that mercury releases may occur at all stages of the lifecycle of a mercury-added product or process. Since mercury is an element, it is neither formed nor destroyed during this lifecycle, but it can change form. In calculating mercury releases from a particular human activity, one first calculates the original mercury input, which is the total amount of mercury that is generated from that activity, then that mercury input is distributed to various media or release pathways during various stages of the lifecycle of the particular product or process. The Toolkit therefore works with the parameters "mercury input" and "output distribution".

Not all the phases in the lifecycle have equal potential for mercury releases. The character of the materials, processes and products determine the lifecycle stages at which significant releases will take place. In calculating the total amount of mercury released from a particular process or product, the Toolkit makes use of activity rates, input factors and output distribution factors. For any particular process or product, the activity rate is the amount of the feed material processed or product produced per unit time, e.g. tonnes or pieces per year. The input factor is the mercury content (e.g. in grams of mercury) per unit of feed material processed or per unit item of product produced or used. The activity rate and the input factor are multiplied together to get the **mercury input** (which is a measure of the total mercury that is within (or can be released) from a process or product).

Ideally, the input factor for a particular process or product should be determined for the process / product in a particular setting / environment / area, meaning that it should be site-specific. However, site-specific input factors have not been developed for most developing countries such as Botswana due to paucity of the data and as such the Toolkit provides default input factors (which were produced during inventories conducted for developed countries). Although this is not the perfect scenario, it is the best available proxy that could be used for developing countries as well.

Once the mercury input has been calculated, it is multiplied by **output distribution factors** to determine the amount of mercury (**output**) that is released through each pathway (air, water, land, product, general waste, or sector specific waste treatment). Different processes or products may be subjected to various pollution abatement systems, (referred to as output scenarios) which will result in differing mercury outputs. The more complex systems will result in reduced mercury outputs.

The amount of mercury released from a particular process or product to a pathway X may therefore be calculated as shown in Equation 1:

Equation 1: Calculation of Mercury Releases

Estimated mercury release to pathway X	=	Activity rate	x	Input factor	x	Output distribution factor for pathway X

The inventory for Botswana was done at the detailed Inventory Level 2 and was carried out according to the UNEP Toolkit methodology described above. Data on activity rate was collected in 2015, as this was selected to be the base year. In some cases, data for 2015 was not available, so the most recent data would then be used. In such cases, the report mentions the year that was used. Where the year is not mentioned, it should be assumed that such data is automatically the data that was collected in 2015.

Data on activity rate was collected by preparing questionnaires for the different sources/sectors which had been identified as being present in Botswana. The questionnaires were sent out, and followed up by telephone, email, and in some cases, face to face interviews. The input factors and output distribution factors that were used were the default ones as given in the Toolkit, since site-specific factors have not been developed for Botswana.

3.4 Summary of the Mercury Release Source Types Present in Botswana

The first part of the inventory was the identification of the sources of mercury which are present in Botswana. It was noted that of the 53 source sub-categories that have been listed as releasing mercury into the environment, 19 are present in Botswana, while the other 34 are absent Table 1.

Table 1: Mercury Sources Present in Botswana

	Source category: Extraction and use of fuels/energy sources	**Source Presence (Y/N/?)**
5.1.1	Coal combustion in power plants	Y
5.1.2	Other coal use	Y
5.1.3	Mineral oils - extraction, refining and use	Y
5.1.4	Natural gas - extraction, refining and use	N
5.1.5	Other fossil fuels - extraction and use	N
5.1.6	Biomass fired power and heat production	N
5.1.7	Geothermal power production	N
	Source category: Primary (virgin) metal production	
5.2.1	Mercury (primary) extraction and initial processing (a	N
5.2.2	Gold (and silver) extraction with mercury amalgamation processes	N
5.3.3	Zinc extraction and initial processing	?
5.3.4	Copper extraction and initial processing	Y
5.3.5	Lead extraction and initial processing	N
5.3.6	Gold extraction and initial processing by methods other than mercury amalgamation	Y
5.3.7	Aluminium extraction and initial processing	N
5.3.8	Other non-ferrous metals - extraction and processing	N
5.3.9	Primary ferrous metal production	N
	Source category: Production of other minerals and materials with mercury impurities	
5.3.1	Cement production	Y
5.3.2	Pulp and paper production	N
5.3.3	Production of lime and light weight aggregates	N

	Source category: Intentional use of mercury in industrial processes	
5.4.1	Chlor-alkali production with mercury-technology	N
5.4.2	VCM production with mercury catalyst	N
5.4.3	Acetaldehyde production with mercury catalyst	N
5.4.4	Other production of chemicals and polymers with mercury	N
	Source category: Consumer products with intentional use of mercury	
5.5.1	Thermometers with mercury	Y
5.5.2	Electrical switches and relays with mercury	Y
5.5.3	Light sources with mercury	Y
5.5.4	Batteries with mercury	Y
5.5.6	Biocides and pesticides with mercury	N
5.5.7	Paints with mercury	N
5.5.8	Cosmetics and related products with mercury	N
	Source category: Other intentional product/process use	
5.6.1	Dental mercury-amalgam fillings (b	Y
5.6.2	Manometers and gauges with mercury	Y
5.6.3	Laboratory chemicals and equipment with mercury	Y
5.6.4	Mercury metal use in religious rituals and folklore medicine	Y
5.6.5	Miscellaneous product uses, mercury metal uses, and other sources	?
	Source category: Production of recycled metals ("secondary" metal production)	
5.7.1	Production of recycled mercury ("secondary production")	N
5.4.2	Production of recycled ferrous metals (iron and steel)	Y
5.4.2	Production of other recycled metals	?
	Source category: Waste incineration*3	
5.8.1	Incineration of municipal/general waste	N
5.8.2	Incineration of hazardous waste	N
5.8.3	Incineration of medical waste	Y
5.8.4	Sewage sludge incineration	N
5.8.5	Informal waste burning	Y
	Source category: Waste deposition/landfilling and wastewater treatment	
5.9.1	Controlled landfills/deposits*3	Y
5.9.2	Diffuse disposal under some control	?
5.9.3	Informal local disposal of industrial production waste	?
5.9.4	Informal dumping of general waste*1*3	Y
5.9.5	Wastewater system/treatment*2	Y
	Source category: Crematoria and cemeteries	
5.10.1	Crematoria/cremation	?
5.10.2	Cemeteries	Y

Y = Present
N = Absent
? = Uncertain

3.5 Summary of Mercury Releases in Botswana

The mercury inventory was conducted as described in Section 3.2. The results from the inventory are summarized in Tables 2 and 3. Table 2 shows the total mercury input and the total mercury output to the various release pathways for each subcategory and percentage contribution made by each subcategory to total national releases of mercury. Table 2 shows the total mercury output for each subcategory. Table 4 shows a more detailed description and definition of the output pathways.

Table 2: Total Mercury Releases to the Various Release Pathways for Each Sub-category

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	2,1					19.8	22	0%
5.2: Primary (virgin) metal production	690	244.4	10 598	471		219	12, 222	49%
5.3: Production of other minerals and materials with mercury impurities*1	8.8			2.9		2.9	15	0%
5.4: Intentional use of mercury in industrial processes								0%
5.5: Consumer products with intentional use of mercury (whole life cycle)	20.9	4.2	1.7		11, 812		11, 856	48%
5.6: Other intentional product/process use*2	131.7	43.9			263.4		439	2%
5.7: Production of recycled metals								0%
5.8: Waste incineration and burning	81.9						82	0%
5.9: Waste deposition/landfilling and wastewater treatment*3*4	4.8	87.1	34.8		26.1	2.1	179	1%
5.10: Crematoria and cemeteries			38.3				38	0%
SUM OF QUANTIFIED RELEASES*3*4	**940**	**293**	**10, 690**	**474**	**12, 102**	**268**	**24, 766**	**100%**

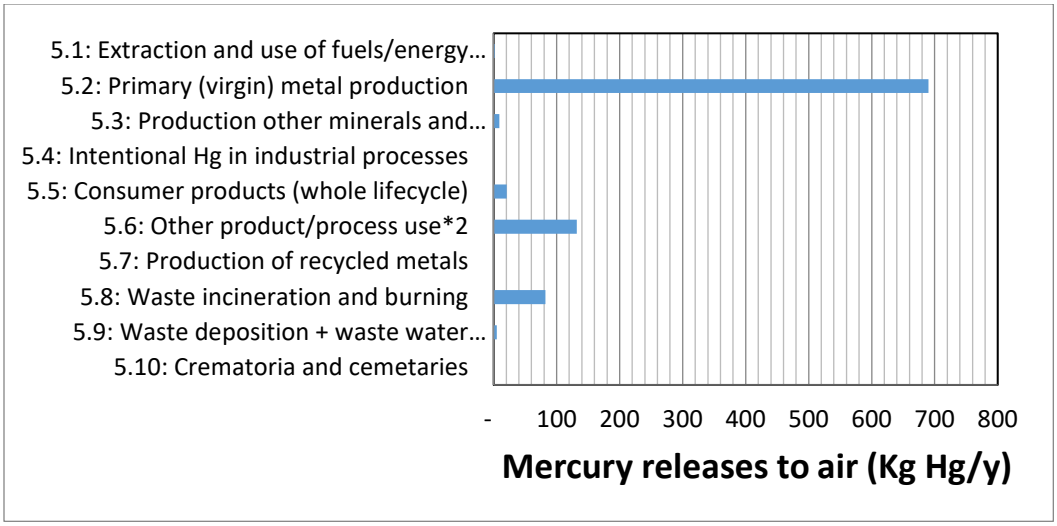


Figure 3: Releases of Mercury to Air in Botswana

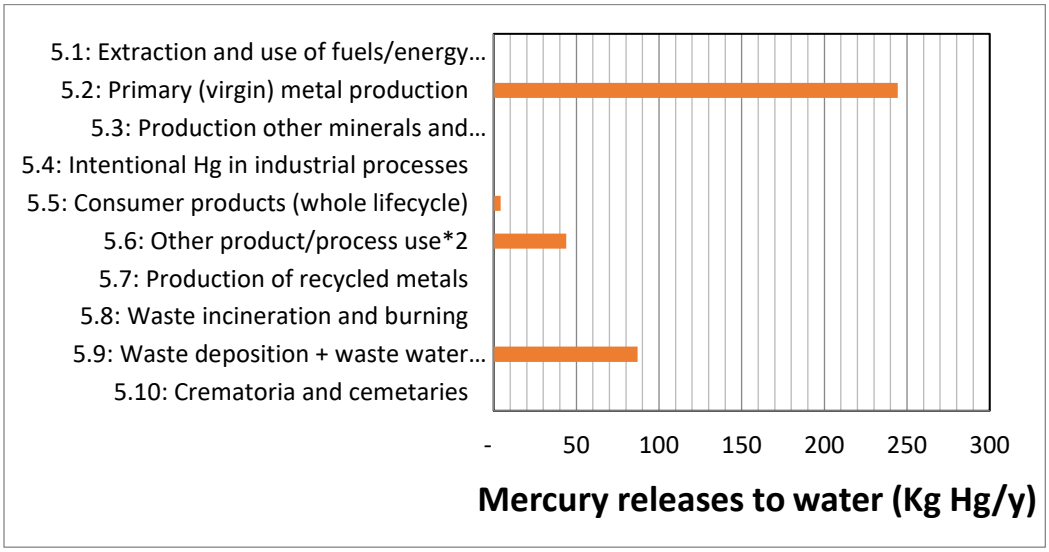


Figure 4: Releases of Mercury to water in Botswana

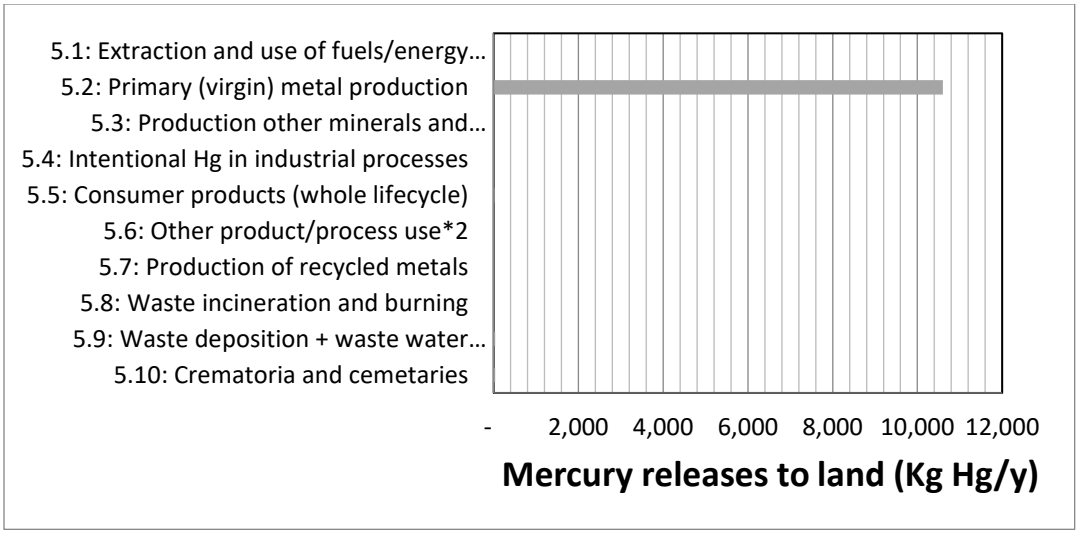


Figure 5: Releases of Mercury to land in Botswana

Figures 3 – 5 and Table 3 show that the individual mercury release sub-categories contributing the highest input to the atmosphere is primary (virgin) metal production. The second highest emissions of mercury into the air comes from extraction and use of fuels/energy sources. For water, the major source is the wastewater some of which arising from waste management and the second largest coming once again from primary (virgin) metal production. For deposition to land, the highest contribution is primary (virgin) metal production followed by waste deposition/landfilling and wastewater treatment.

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 of mercury contents in waste and wastewater, and these data were only available from developed countries. The calculations made indicate that the default input factors for general waste and wastewater do almost likely over-estimate the mercury releases from these sources. Follow-up is therefore necessary to get a lot more accurate scenario based on local conditions as this was not achieved in this study.

Mercury contaminated sites were not achieved in this work due to lack of data about such hotspots in the country. To achieve this, a country has to know where such hotspots are based and the history of each individual hotspot. As a result, the source of the mercury is the mercury added products. This is because most mercury added products (batteries, electrical switches, compact florescent lamps, etc) end up in disposal sites due to lack of segregation of municipal waste in the country. All such disposal sites should be suspected to be contaminated however concentration levels would need to be determined. Gaborone and Francistown are the largest cities and are the main industrial areas generating the highest waste volumes. It is in these two areas where sizable disposal sites are located. In both areas there is some form of waste management in place but there are areas of concern which warrant some form of mitigation measures to be applied.

Tables 3 and 4 below give a summary of mercury releases from all source categories. The key mercury releases here are releases to air (the atmosphere), to water (marine and freshwater bodies, including via wastewater systems), to land, to general waste, and to sectors specific waste. An additional output pathway is "by-products and impurities" which designates mercury flows back into the market with by-products and products.

The sector with the highest release to air is primary (virgin) metal production at 690Kg/year and the lowest is production of other minerals and materials with mercury impurities at 8.8Kg/year. The release to water, has the highest release coming from primary (virgin) metal production with a total of 244Kg/year and the lowest is consumer products with intentional use of mercury (whole life cycle) at 4.2Kg/year. Under release to land the highest release came from primary (virgin) metal production at 10,598 Kg/year and the lowest is from consumer products with intentional use of mercury (whole life cycle) at 18.7 Kg/year. As far as general waste is concerned, the sector with the highest release was consumer products with intentional use of mercury (whole life cycle) at 11,812 Kg/year and the lowest release came from waste deposition/landfilling and wastewater treatment at 26.1 Kg/year. In the sector specific waste disposal, the sector that had the most release was primary (virgin) metal production with a total of 219 Kg/year and lowest was extraction and use of fuel/energy sources at 19.8 Kg/year (Table 3.5).

Table 3: Summary data of estimated mercury releases per source category

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**
5.1: Extraction and use of fuels/energy sources	2					20	22
5.2: Primary (virgin) metal production	690	244	10 598	471		219	12 222
5.3: Production other minerals and materials*1	9			3		3	15
5.4: Intentional Hg in industrial processes							
5.5: Consumer products (whole lifecycle)	21	4	19		11 812		11 856
5.6: Other product/process use*2	132	44			263		439
5.7: Production of recycled metals							
5.8: Waste incineration and burning	82						82
5.9: Waste deposition + wastewater treatment*3*4	5	87	35		26	26	179
5.10: Crematoria and cemeteries			38				38
SUM OF QUANTIFIED RELEASES*3*4	**940**	**293**	**10, 690**	**474**	**12, 102**	**268**	**24, 766**

Table 4: Summary of the Mercury Releases and Emissions

C	Sub-C	Source category	Exists? y/n/?	Calculated 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	Y	20	0	0	0	0	0,0	20
	5.1.2	Other coal use	Y	0	0	0	0	0	0	0
	5.1.3	Mineral oils - extraction, refining and use	Y	2	2	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	N	0	0	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**								
	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	N	0	0	0	0	0	0	0

		amalgamation processes								
	5.3.3	Zinc extraction and initial processing	N	0	0	0	0	0	0	0
	5.3.4	Copper extraction and initial processing	Y	447	219	9	0	0	0	219
	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	11776	471	236	10598	471	0	0
	5.3.7	Aluminium extraction and initial processing	N	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	N	0	0	0	0	0	0	0
5.3		**Source category: Production of other minerals and materials with mercury impurities**								
	5.3.1	Cement production	Y	15	9	0	0	3	0	3
	5.3.2	Pulp and paper production	N	0	0	0	0	0	0	0
	5.3.3	Production of lime and light weight aggregates	N	0	0	0	0	0	0	0
5.4		**Source category: Intentional use of mercury in industrial processes**								

	5.4.1	Chlor-alkali production with mercury-technology	N	0	0	0	0	0	0	0
	5.4.2	VCM production with mercury catalyst	N	0	0	0	0	0	0	0
	5.4.3	Acetaldehyde production with mercury catalyst	N	0	0	0	0	0	0	0
	5.4.4	Other production of chemicals and polymers with mercury	N	0	0	0	0	0	0	0
5.5		**Source category: Consumer products with intentional use of mercury**								
	5.5.1	Thermometers with mercury	Y	14	1	4	0	-	8	0
	5.5.2	Electrical switches and relays with mercury	Y	187	19	0	19	-	150	0
	5.5.3	Light sources with mercury	Y	17	1	0	0	-	16	0
	5.5.4	Batteries with mercury	Y	11638	0	0	0	-	11638	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	N	0	0	0	0	-	0	0
5.6		**Source category: Other intentional product/process use**								
	5.6.1	Dental mercury-amalgam fillings (b	Y	439	132	44	0	0	263	0

	5.6.2	Manometers and gauges with mercury	Y	0	0	0	0	0	0	0
	5.6.3	Laboratory chemicals and equipment with mercury	Y	0	0	0	0	0	0	0
	5.6.4	Mercury metal use in religious rituals and folklore medicine	Y	0	0	0	0	0	0	0
	5.6.5	Miscellaneous product uses, mercury metal uses, and other sources	N	0	0	0	0	0	0	0
5.7		**Source category: Production of recycled metals ("secondary" metal production)**								
	5.7.1	Production of recycled mercury ("secondary production")	N	0	0	0	0	-	0	0
	5.4.2	Production of recycled ferrous metals (iron and steel)	Y	0	0	0	0	0	0	0
	5.4.2	Production of other recycled metals	?	0	0	0	0	0	0	0
5.8		**Source category: Waste incineration*3**								
	5.8.1	Incineration of municipal/general waste	N	0	0	0	0	0	0	0
	5.8.2	Incineration of hazardous waste	N	0	0	0	0	0	0	0
	5.8.3	Incineration of medical waste	Y	82	82	0	0	0	0	0
	5.8.4	Sewage sludge incineration	N	0	0	0	0	0	0	0

	5.8.5	Informal waste burning	Y	0	0	0	0	0	0	0
5.9		**Source category: Waste deposition/landfilling and wastewater treatment**								
	5.9.1	Controlled landfills/deposits*3	Y	5	5	0	0	0	0	0
	5.9.2	Diffuse disposal under some control	-	0	-	-	-	-	-	-
	5.9.3	Informal local disposal of industrial production waste	N	0	0	0	0	-	-	-
	5.9.4	Informal dumping of general waste*1*3	Y	0	0	0	0	-	-	-
	5.9.5	Wastewater system/treatment*2		174	0	87	35	0	26	26
5.10		**Source category: Crematoria and cemeteries**								
	5.10.1	Crematoria/cremation	?	0	0	0	0	-	0	0
	5.10.2	Cemeteries	Y	38	0	0	38,3	-	0	0
SUM OF QUANTIFIED INPUTS AND RELEASES *1*2*3*4				**24 ,775**	**940**	**293**	**10, 690**	**473.97**	**12,101.51**	**268**

Table 5: Description of the Types of Results for Mercury Releases and Emissions

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 amount 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, etc.
Water	Mercury releases to aquatic environments and to wastewater 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.

3.6 Extraction and use of fuels/energy sources

Botswana has massive coal resources in the eastern part of the country, estimated at 17 billion tons. The country produced 1,318,450 tons of coal in 2005. The quality of coal is suitable for power generation. Botswana has one operating mine, the Morupule mine and supplies coal to Morupule Thermal Power Station as well as to the mining operations at Selebi Phikwe and to the Sua Pan soda plants. There are large untapped reserves in the greater Morupule and Mmamabula coal fields of the eastern Botswana, and potential for developing additional capacity for export to the global steam-coal market.

The total 1,318,450 is anthracite and is not washed. A total of 272,192 tons of hard coal is sub-bituminous brown coal and is washed.

3.6.1 Coal combustion in Power Plants

Table 6 shows that the output release pathway from coal combustion in power plants is through air and a total of 198kg Hg/y is released. The output distribution factor of 1kg Hg/y was used.

3.6.2 Other Coal Uses

A total of 272,192 tons of hard coal (anthracite and bituminous) is used in Botswana for other uses resulting in an input factor for phase of 0.15 gHg/t. Table 6 shows that the output release pathway from coal combustion under other uses is through air and a total of 41kg Hg/y is released. The output distribution factor of 1kgHg/y was used.

Table 6: Coal combustion in Power Plants

Combustion of Sub-bituminous brown coal (Washed)	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	t/y		1,318,450	2,100
Input factor for phase	g Hg/t		0.15	0.15
Calculated input to phase	Kg Hg/y		198	198
Output distribution factors for phase:				
- Air	Kg Hg/y		1	1
- Water			-	-
- Land			-	-
- Products			-	-
- General waste treatment			-	-
- Sector specific waste treatment			-	-
Calculated outputs/releases to:				
- Air	Kg Hg/y		198	198
- Water			-	-
- Land			-	-
- Products			-	-
- General waste treatment			-	-
- Sector specific waste treatment			-	-

Table 7: Other Coal Uses

Other coal uses (of hard coal (anthracite and bituminous)	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	t/y		272,192	272,192
Input factor for phase	g Hg/t		0.15	0.15
Calculated input to phase	Kg Hg/y		41	41
Output distribution factors for phase:				
- Air	Kg Hg/y		1	1
- Water			-	-
- Land			-	-
- Products			-	-
- General waste treatment			-	-
- Sector specific waste treatment			-	-
Calculated outputs/releases to:				
- Air	Kg Hg/y		41	41
- Water			-	-
- Land			-	-
- Products			-	-
- General waste treatment			-	-
- Sector specific waste treatment			-	-

3.7 Primary (virgin) metal production

3.7.1 Copper Extraction and initial processing

According to Table 7, 14,896 tons per annum of copper is produced from concentrates in Botswana. This gives a calculated mercury input of 447kgHg/y. With the output distribution factor for air of 0.9 and 0.1 for water, the calculated output releases resulting are 402.3kg Hg/y to air and 44.7kgHg/year to water.

3.7.2 Gold extraction and initial processing by methods other than mercury amalgamation

According to Table 8, 785,033.60 tons per annum of gold is extracted by methods other than mercury amalgamation in Botswana. This gives a calculated mercury input of 15kg Hg/y. With the output distribution factor for air of 0.04, 0.02 for water, 0.9 for land and 0.04 in the product. The calculated output releases resulting are 471.02 kg Hg/y to air, 235.51 Kg Hg/year to water, 10,597.95 Kg Hg/year to land and 471.02 KgHg/year remains in the gold.

Table 8: Primary (virgin) metal production (Copper)

Copper Extraction and Initial processing Production from copper concentrates	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	t/y		14,896	14,896
Input factor for phase	g Hg/t		30	30
Calculated input to phase	Kg Hg/y		447	447
Output distribution factors for phase:				
- Air	Kg Hg/y		0.9	0.9
- Water			0.1	0.1
- Land			-	-
- Products			-	-
- General waste treatment			-	-
- Sector specific waste treatment			-	-
Calculated outputs/releases to:				
- Air	Kg Hg/y		402.3	402.3
- Water			44.7	44.7
- Land			-	-
- Products			-	-
- General waste treatment			-	-
- Sector specific waste treatment			-	-

Table 9: Primary (virgin) metal production (Gold)

Gold extraction and initial processing by methods other than mercury amalgamation	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	t/y		785,033.60	785,033.60
Input factor for phase	g Hg/t		15	15
Calculated input to phase	Kg Hg/y		11,776	11,776
Output distribution factors for phase:				
- Air	Kg Hg/y		0.04	0.04
- Water			0.02	0.02
- Land			0.9	0.9
- Products			0.04	0.04
- General waste treatment			-	-
- Sector specific waste treatment			-	-
Calculated outputs/releases to:				
- Air	Kg Hg/y		471.02	471.02
- Water			235.51	235.51
- Land			10,597.95	10,597.95
- Products			471.02	471.02
- General waste treatment			-	-
- Sector specific waste treatment			-	-

3.8 Production of other minerals and materials with mercury impurities

3.8.1 Cement production without co-incineration of waste

It appears 133,991 tons of biomass is used annually in Botswana. The output distribution to air resulting is 15kg Hg/year as Table 9 indicates. The data presented is most likely an underestimation given the fact that biomass consumption by rural population is high and yet goes unaccounted. Only imported biomass is used since there are records available. Since the imported biomass is most likely a tiny fraction of the biomass consumed in the country, this figure of 15 kg/yr of Hg is a gross underestimation once rural use of biomass is considered. There is a need for an improvement in natural resource economics data capturing such that biomass consumption data is well articulated.

Table 10: Cement Production

Without co-incineration of waste	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of lifecycle
Activity rate	t/y		133,991		133,991
Input factor for phase	g Hg/t		0.11		0.11
Calculated input to phase	Kg Hg/y		15		15
Output distribution factors for phase:					
- Air	Kg Hg/y		1		1
- Water			-		-
- Land			-		-
- Products			-		-
- General waste treatment			-		-
- Sector specific waste treatment			-		-
Calculated outputs/releases to:					
- Air	Kg Hg/y		15		15
- Water			-		-
- Land			-		-
- Products			-		-
- General waste treatment			-		-
- Sector specific waste treatment			-		-

3.9 Consumer products with intentional use of Mercury

3.9.1 Thermometers with Mercury

According to the available data, Botswana had a total of 558 thermometers with mercury. This is likely to be an underestimation of the true picture in the country based on comparison with countries of similar populations and comparable developmental level.

There is a need for embarking on awareness and education programmes to all stakeholders in the identification mercury containing thermometers and information storage so that in the future all national information can also be incorporated. It is therefore obvious that the data presented in this report on this matter is a gross under representation because of this factor.

3.9.2 Electrical switches and relays with Mercury

For this source sub-category, the calculations were based on electrification rate and population size. Electrification was mainly in the urban areas for many years. Recently, the government has embarked on an aggressive electrification campaign that is including rural areas nationwide.

3.9.3 Light sources with Mercury

A total of 613,295 light sources were recorded as imported. This number may equally be an underestimation due to the rapid electrification that has happened in the country in the past decade. The improvement in the data in the future from imports records will improve the estimation of this sector to the releases and emissions in the country. This is one sector that is likely going to increase in emissions and releases as well as most people switch to mercury added energy serving lights.

3.9.4 Batteries with Mercury

It has been estimated that there are 2,053 tons of batteries with mercury that were imported into the country during the survey period. Botswana does not these kinds of batteries they are all imported and therefore an improvement in the imports data will improve the estimation from this source category. Also, by controlling the imports, the government can easily control the level of mercury releases from this source category.

3.9.5 Polyurethane with Mercury Catalysts

For this source sub-category, the calculations were based on the population size.

3.10 Dental Mercury Amalgam Fillings

Based on the default values in the toolkit and the population of Botswana, there are 0.829 dentists per 1, 000 people. The use of dental amalgam by these dentists is widespread in the country due to various factors including perception and thus demand by the patients. There is a perception of reliability of mercury added amalgams from both the patients and the dentists. And there is a very low perception of risk coming from this source to the patient. If these perceptions continue, it will not be easy to attain an increasing use of the alternatives despite the fact that they are already available in the market.

To achieve the necessary transition, a special attention must be given to the dentists. They are a key stakeholder group that will encourage the change in behaviour. Patients do not as a matter of fact know enough about these products that are highly specialized to dictate to the dentists who are professionals in their area. The balance of power is tilted towards the dentists in the decision-making phase while the impacts are borne by the patients. While awareness is a good tool, in this case where patients may suffer the impacts arising from the highly professional decisions of their trusted caregivers, perhaps a regulatory approach may be considered.

3.11 Manometers and Gauges with Mercury

There are 47 medical blood pressure gauges that were found to be imported and in use. The toolkit has provided for other manometers and gauges using the electrification rate and the population.

3.12 Laboratory Chemicals and Equipment with Mercury

Equipment with mercury such as thermometers, pressure gauges, manometers and barometers have also been identified in hospitals, schools and weather stations. Nevertheless, the toolkit has calculated Mercury releases from these sources using the population and electrification rate. There was a challenge in establishing quantities of chemicals and equipment with mercury in the health sector hence the reason for opting to use the electrification to population ratio.

3.13 Mercury metal use in religious rituals and medicine

The use of mercury in rituals and folklore in Botswana is unclear yet it remains probable given the fact that other populations in the region with relatively similar cultural practices use mercury. The field work that was conducted by DPCWM did not come up with any information on this matter and as such it is not possible to discern any information that could be used for mercury releases and emissions from this source. It is obvious that going forward, more deliberate effort must be made to understand how Batswana especially rural people, traditional doctors, religious groups and the population at large perceive and therefore may use mercury.

Table 11: Thermometers with Mercury

Medical Thermometers	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Items/year		558	558
Input factor for phase	g Hg/item		1	1
Calculated input to phase	Kg Hg/y		1	1
Output distribution factors for phase:				
- Air	Kg Hg/y		0.1	0.1
- Water	Kg Hg/y		0.3	0.3
- Land			-	-
- Products			-	-
- General waste treatment	Kg Hg/y		0.6	0.6
- Sector specific waste treatment	Kg Hg/y		-	-
Calculated outputs/releases to:				
- Air	Kg Hg/y		0.1	0.1
- Water	Kg Hg/y		0.3	0.3
- Land			-	-
- Products			-	-
- General waste treatment	Kg Hg/y		0.6	0.6
- Sector specific waste treatment	Kg Hg/y		-	-

Table 12: Electrical Switches and Relays with Mercury

Electrical switches and relays with Mercury	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Inhabitants		2,195,134	2,195,134
Input factor for phase	gHg/(y*inhabitant)		0.14	0.14
Calculated input to phase	Kg Hg/y		187	187
Output distribution factors for phase:				
- Air			0.1	0.1
- Water				
- Land			0.1	0.1
- Products				
- General waste treatment			0.8	0.8
- Sector specific waste treatment				
Calculated outputs/releases to:				
- Air	Kg Hg/y		18.7	18.7
- Water				
- Land	Kg Hg/y		18.7	18.7
- Products				
- General waste treatment	Kg Hg/y		149.6	149.6
- Sector specific waste treatment				

Table 13: Light Sources with Mercury

Light sources with Mercury	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Items/y		613,295	613,295
Input factor for phase	mg Hg/item		10-30	10-30
Calculated input to phase	Kg Hg/y		16.57	16.57
Output distribution factors for phase:				
- Air	Kg Hg/y		0.05	0.05
- Water			-	-
- Land	Kg Hg/y		-	-
- Products			-	-
- General waste treatment	Kg Hg/y		0.95	0.95
- Sector specific waste treatment				
Calculated outputs/releases to:				
- Air	Kg Hg/y		0.83	0.83
- Water			-	-
- Land	Kg Hg/y		-	-
- Products			-	-
- General waste treatment	Kg Hg/y		15.74	15.74
- Sector specific waste treatment				

Table 14: Batteries with Mercury

Batteries with Mercury	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	t/y		2053	2053
Input factor for phase	Kg Hg/t		0.25 - 320	0.25 – 320
Calculated input to phase	Kg Hg/y		11638	11638
Output distribution factors for phase:				
- Air	Kg Hg/y		-	-
- Water			-	-
- Land	Kg Hg/y		-	-
- Products			-	-
- General waste treatment	Kg Hg/y		1	1
- Sector specific waste treatment				
Calculated outputs/releases to:				
- Air	Kg Hg/y		-	-
- Water			-	-
- Land	Kg Hg/y		-	-
- Products			-	-
- General waste treatment	Kg Hg/y		11638	11638
- Sector specific waste treatment				

Table 15: Polyurethane with Mercury Catalysts

Polyurethane with Mercury catalyst	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Inhabitants		1,909,321	1,909,321
Input factor for phase	gHg/(y*inhabitant)		0.03	0.03
Calculated input to phase	Kg Hg/y		22.33	22.33
Output distribution factors for phase:				
- Air			0.2	0.2
- Water			0.1	0.1
- Land			0.4	0.4
- Products				
- General waste treatment			0.3	0.3
- Sector specific waste treatment				
Calculated outputs/releases to:				
- Air	Kg Hg/y		4.47	4.47
- Water	Kg Hg/y		2.23	2.23
- Land	Kg Hg/y		8.94	8.94
- Products				
- General waste treatment	Kg Hg/y		6.7	6.7
- Sector specific waste treatment				

Table 16: Dental Mercury Amalgam Fillings

Dental Mercury amalgam filling	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Inhabitants		2,195,134	2,195,134
Input factor for phase	gHg/(y*inhabitants)		0.8	0.8
Calculated input to phase	Kg Hg/y		439	439
Output distribution factors for phase:				
- Air	Kg Hg/y		0.3	0.3
- Water	Kg Hg/y		0.1	0.1
- Land				
- Products				
- General waste treatment	Kg Hg/y		0.6	0.6
- Sector specific waste treatment	Kg Hg/y			
Calculated outputs/releases to:				
- Air	Kg Hg/y		131.71	0.15
- Water	Kg Hg/y		43.90	43.90
- Land			-	-
- Products			-	-
- General waste treatment	Kg Hg/y		263.42	263.42
- Sector specific waste treatment	Kg Hg/y		-	-

Table 17: Manometers and Gauges with Mercury

Manometers and Gauges with Mercury	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Items/y		94	94
Input factor for phase	g Hg/item		80	80
Calculated input to phase	Kg Hg/y		8	8
Output distribution factors for phase:				
- Air	Kg Hg/y		0.1	0.1
- Water	Kg Hg/y		0.3	0.3
- Land				
- Products				
- General waste treatment	Kg Hg/y		0.6	0.6
- Sector specific waste treatment	Kg Hg/y			
Calculated outputs/releases to:				
- Air	Kg Hg/y		0.80	0.80
- Water	Kg Hg/y		2.40	2.40
- Land				
- Products				
- General waste treatment	Kg Hg/y		4.80	4.80
- Sector specific waste treatment	Kg Hg/y			

Table 18: Laboratory Chemicals and Equipment with Mercury

Laboratory chemicals and equipment with Mercury	**Unit**	**Production**	**Use**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	Inhabitants		2,195,134	2,195,134
Input factor for phase	g Hg/y*inhabitants		0.01-0.04	0.01-0.04
Calculated input to phase	Kg Hg/y		66.62	66.62
Output distribution factors for phase:				
- Air				
- Water	Kg Hg/y		0.33	0.33
- Land				
- Products				
- General waste treatment	Kg Hg/y		0.33	0.33
- Sector specific waste treatment	Kg Hg/y		0.34	0.34
Calculated outputs/releases to:				
- Air				
- Water	Kg Hg/y		21.99	21.99
- Land				
- Products				
- General waste treatment			21.99	21.99
- Sector specific waste treatment	Kg Hg/y		22.65	22.65

3.14 Waste incineration and burning

3.14.1 Incineration of Medical Waste

According to available data from the inventory, 3,413,712 tons of medical waste is incinerated per annum in Botswana. This high number suggests that most health facilities have incinerators within their premises to handle medical waste generated at the facility. The challenge is the management of the air emissions resulting from the incineration of such medical waste. The results show that minimal or no air abatement mechanisms are available with such incinerators resulting in air pollution and the release of mercury to the environment.

3.14.2 Informal waste burning

Informal waste burning is a typical problem in most urban cities not only in Botswana but in most developing countries. A total of 7,557.66 tons of waste is informally burned per annum in Botswana according to the inventory results.

This figure may be an underestimation bearing in mind that most cities/towns have a challenge with record keeping and thus do not have true figures on the amount of waste generated in their cities/towns later on the whole country. The waste that eventually ends up at the landfill or waste disposal sites is not weighed and this complicates the determination of waste that ends up burned accurately. To overcome this challenge, it is important for the responsible institution to collect data on waste generation to make accurate assumptions of waste burned.

In this inventory, default input factors were used for the estimation of mercury releases from general waste treatment. The default factors were based on literature data of mercury which came from the developed countries as indicated earlier.

Table 19: Incineration of Medical Waste

Incineration of medical waste	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of lifecycle
Activity rate	t/y			3,413,712	3,413,712
Input factor for phase	g Hg/t waste incinerated			24	24
Calculated input to phase	Kg Hg/y			82	82
Output distribution factors for phase:					
- Air	Kg Hg/y			1	1
- Water					
- Land					
- Products					
- General waste treatment					
- Sector specific waste treatment					
Calculated outputs/releases to:					
- Air	Kg Hg/y			82	82
- Water					
- Land					
- Products					
- General waste treatment					
- Sector specific waste treatment					

Table 20: Informal Waste Burning

Informal waste burning	**Unit**	**Production**	**Use**	**Disposal**	**Sum of releases to pathway from assessed part of lifecycle**
Activity rate	t/y			7557.66	7557.66
Input factor for phase	g Hg/t			5	5
Calculated input to phase	Kg Hg/y			38	38
Output distribution factors for phase:					
- Air	Kg Hg/y			1	1
- Water					
- Land					
- Products					
- General waste treatment					
- Sector specific waste treatment					
Calculated outputs/releases to:					
- Air	Kg Hg/y			38	38
- Water					
- Land					
- Products					
- General waste treatment					
- Sector specific waste treatment					

3.15 Waste disposal, deposition/landfilling

3.15.1 Controlled landfills/deposits

A total of 95,459 tons of waste disposed-off at controlled landfill or semi-controlled dumpsites. The government of Botswana has over the years tried to make waste management a priority with the construction of engineered landfills in urban areas. However, the management of these sites over the years has not met the standards that need to be adhered to and to a very large extent they are being treated as ordinary dumpsites.

3.15.2 Informal dumping of general waste

Approximately 7,561,714 tons of waste was informally dumped according to inventory results obtained in Botswana. This is a huge number compared to the amount of waste that goes to controlled landfills or deposits. A sound strategy of reversing this trend needs to be put in place if informal dumping of waste and ultimately opening air burning of waste is going to be reduced in Botswana.

Table 21: Controlled Landfills/Deposits

Controlled landfills/deposits	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of lifecycle
Activity rate	t/y			95,459	95,459
Input factor for phase	g Hg/t			5	5
Calculated input to phase	Kg Hg/y			477	477
Output distribution factors for phase:					
- Air	Kg Hg/y			0.01	0.01
- Water	Kg Hg/y			0.0001	0.0001
- Land					
- Products					
- General waste treatment					
- Sector specific waste treatment					
Calculated outputs/releases to:					
- Air	Kg Hg/y			4.77	4.77
- Water	Kg Hg/y			0.05	0.05
- Land					
- Products					
- General waste treatment					
- Sector specific waste treatment					

Table 22: Informal Dumping of General Waste

Informal dumping of general waste	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of lifecycle
Activity rate	t/y			7,561,714	7,561,714
Input factor for phase	g Hg/t			5	5
Calculated input to phase	Kg Hg/y			3,781	3,781
Output distribution factors for phase:					
- Air	Kg Hg/y			0.1	0.1
- Water	Kg Hg/y			0.1	0.1
- Land	Kg Hg/y			0.8	0.8
- Products					
- General waste treatment					
- Sector specific waste treatment					
Calculated outputs/releases to:					
- Air	Kg Hg/y			378.09	378.09
- Water	Kg Hg/y			378.09	378.09
- Land	Kg Hg/y			3,024.69	3,024.69
- Products					
- General waste treatment					
- Sector specific waste treatment					

3.16 Wastewater system/treatment

A phenomenal amount of 33,146,154 m^3 of wastewater is treated by the Water and Sewerage Companies and various other entities in Botswana per annum. This is a staggering figure for a semi-arid country such as Botswana. Over 64 wastewater treatment facilities exist in Botswana. Most wastewater that is being treated in these systems is in Gaborone, Francistown, Selebi Phikwe, Lobatse and Orapa which together account for around 80 percent of wastewater. Other than that, most of the towns and villages do not have systems that treat wastewater. In those areas, wastewater is openly dumped on land around homesteads. This practice is not only unique to Botswana but characteristic of most developing countries. Since the rural areas are not covered by the organized government institutions on these matters, there is no data nor mechanisms to obtain it.

The National Master Plan for Wastewater and Sanitation (NMPWWS) is a long-term strategy for wastewater treatment, re-use and recycling and was preceded by the Policy for Wastewater and Sanitation Management (GOB, 2003). The purpose of this policy is "to promote the health and wellbeing of Batswana through the provision of appropriate and sustainable wastewater/sanitation management and to introduce mechanisms for the protection and conservation of water resources" (GOB, 2003).

The plan contains a comprehensive and ambitious investment plan to construct sewerage and wastewater treatment plants in all cities, towns and major villages in Botswana. Though reuse and recycling are promoted, the plan emphasises wastewater treatment on discharge and it is not considered as an economic good. However, this is slowly changing, and a rapidly growing amount of wastewater is available largely due to improved sanitation, growing water consumption and expansion of the treatment facilities. The policy identifies the need to improve the quality of wastewater treatment to produce acceptable water quality of outflows, as per the requirements of the national water quality standards. This is necessary to meet the target for 96% re-use and recycling of the outflow of treatment works by the year 2030 (GOB, 2003).

A major challenge of these facilities is poor record keeping and the lack of flow meters to measure the actual volume of the effluent. As a result, the amount of waste reflected in this report is based on the volumetric capacity of the treatment facilities and not on the actual flows. The flow meters are to be installed in treatment facilities by the responsible institution to measure the volume of effluent.

Table 23: Wastewater System/ Treatment

Wastewater system/treatment	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of lifecycle
Activity rate	m^3/y			33,146,154	33,146,154
Input factor for phase	mg Hg/ m^3			5.25	5.25
Calculated input to phase	Kg Hg/y			174	174
Output distribution factors for phase:					
- Air	Kg Hg/y			-	-
- Water				0.5	0.5
- Land				0.2	0.2
- Products				-	-
- General waste treatment	Kg Hg/y			0.15	0.15
- Sector specific waste treatment	Kg Hg/y			0.15	0.15
Calculated outputs/releases to:					
- Air	Kg Hg/y				
- Water				87.01	87.01
- Land				34.80	34.80
- Products					
- General waste treatment	Kg Hg/y			26.10	26.10
- Sector specific waste treatment	Kg Hg/y			26.10	26.10

3.17 Crematoria and cemeteries

3.17.1 Crematoria/Cremation

Mercury inventory results show that there are no cremations done in Botswana despite the presence of companies offering the service, cultures and religious persuasions that practice cremation. This may need to be verified as there is a high possibility that cremations do occur in the country. The government may have to engage the concerned stakeholders and communities in order to get the real picture on the ground. It is also possible that some cremation is done in South Africa due to the close proximity to Botswana and likely better cremation facilities and privacy.

3.17.2 Cemeteries

Botswana has a life expectancy of 66.80 as at 2017. The inventory results showed that 15,320 corpses are buried annually or 9.5 deaths per 1000 population. The reliability of such data depends on the government system of recording death and burials both at local and national level. This results in 38.3 kg Hg/yr.

Table 24: Cemeteries

Cemeteries	Unit	Production	Use	Disposal	Sum of releases to pathway from assessed part of lifecycle
Activity rate	Corpses buried/y			15,320	15,320
Input factor for phase	g Hg/corpse			2.5	2.5
Calculated input to phase	Kg Hg/y			38.3	38.3
Output distribution factors for phase:					
- Air					
- Water					
- Land	Kg Hg/y			1	1
- Products					
- General waste treatment					
- Sector specific waste treatment					
Calculated outputs/releases to:					
- Air					
- Water					
- Land	Kg Hg/y			38.3	38.3
- Products					
- General waste treatment					
- Sector specific waste treatment					

Chapter 4: Legal, Regulatory and Institutional Review

An analysis of Botswana's policy and legal framework shows that mercury use, and management are not specifically dealt with in one piece of legislation. Mercury is mentioned in various pieces of legislation which deal with various aspects of the environment as will be shown below. This sectoral legislation is the achille's hill of chemical management in Botswana.

Environmentally sound management of chemicals generally, is still a serious challenge for many developing countries and therefore, progress in chemicals management has not kept pace with their use and the environment continues to suffer from air, water and land contamination, impairing the health and welfare of millions of people.

The Department of Waste Management and Pollution Control has commissioned a review of policy and institutional arrangement and legal framework for management of Mercury in Botswana with the aim of complying with the Minamata Convention.

Botswana has various pieces of legislation relating to chemical management and handling. The following pieces of legislation directly deal with chemical management and handling in Botswana:

i. The Explosives Act 1962. Chap. 24:02
ii. Atmospheric Pollution (Prevention) Act, 1971. Chap. 65:03
iii. Drugs and Related Substances Act, 1992. Chap. 63:04
iv. Radiation Protection Act 2006, Chap. 24:03
v. The Waste Management Act 1998, Chap. 65:06
vi. The Public Health Act 1981, Chap. 63:01
vii. The Factories Act 1979, Chap. 44:01
viii. The Agrochemicals Act 2006, Chap. 35:09

4.1 The Explosives Act

The preamble to the Explosives Act states that the Act is to provide for the control of the manufacture, importation, sale, transport, storage, use and disposal of explosives and for matters incidental thereto.

Under Section 2, an explosive is defined as (a) nitroglycerine, dynamite, guncotton, blasting powders, fulminate of mercury or of other metals, coloured fires, and every other substance or mixture which is used or manufactured with a view to producing a practical effort of explosion or a pyrotechnic effect ; (*b*)any fuse, rocket, detonator, cartridge, and every adaptation or preparation of any explosive as herein defined; (*c*)any other substance which the President may by regulation, made under section 4 declare to be an explosive; but shall not include any ammunition within the meaning of the Arms and Ammunition Act.

Section 3 empowers the Minister, by a Notice published in the Gazette, to appoint officers for the administration of the Act. The Minister may appoint a Chief Inspector of Explosives; one or more Inspectors of Explosives; Assistant Inspectors of Explosives; and such other officers as may be required.

Under Section 4, the President is empowered to make various regulations. The President may make;

a) *prohibiting or regulating the importation and transit of explosives;*
b) *regulating the transport and storage of explosives;*
c) *regulating the sale of and dealing in explosives;*
d) *prohibiting the introduction of explosives into any specified areas;*
e) *prohibiting the possession of explosives by any specified class of persons;*
f) *prohibiting or regulating the manufacture of explosives;*
g) *regulating the use of explosives;*
h) *regulating the disposal of explosives;*
i) *prescribing the fee to be paid for any license or permit issued or examination or inspection made under or in pursuance of regulations;*
j) *Providing for the seizure and forfeiture of any explosives in respect of which any offence against any regulations made under this section has been committed.*

Section 6 allows the Chief Inspector, after suitable investigation that any person has committed an offence, to summarily demand payment of a fine not exceeding P10 for such offence.

Commentary

The Act establishes some administrative regime for the control of chemicals of an explosive nature. It imposes the role of appointing officers on the Minister and then puts the role of making regulations on the President. The Act does not address Mercury use and Management specifically. It is not immediately helpful in Implementation of the Minamata Convention.

4.2 The Atmospheric Pollution (Prevention) Act

The Atmospheric Pollution (Prevention Act) deals with the prevention of pollution of the atmosphere by carrying on industrial processes. The Act controls the handling and management of noxious or offensive gases from industrial processes.

The Scope of Application

The Act applies to emission of objectionable matter by industrial processes in a controlled area. “Industrial process" means any process prescribed by the Minister which is involved in any trade, occupation or manufacture devoted to production by physical, mechanical, electrical, chemical or thermal means, including any process involved in metallurgical operations, operations for the generation of power, and ancillary operations. "Objectionable matter" means smoke, gases including noxious or offensive gases, vapours, fumes, grit, dust or other matter capable of being dispersed or suspended in the atmosphere which is produced or is likely to be produced by any industrial process. "Noxious or offensive gases" means any of the following groups of compounds when in the form of gas, namely, hydrocarbons; alcohols; aldehydes; ketones; ethers; esters; phenols; organic acids and their derivatives; halogens, organic nitrogen, organic sulphur, sulphur and halogen compounds; cyanides; cyanogens; ammonia and its compounds; inorganic acids; fumes containing antimony, arsenic, beryllium, chromium, cobalt, copper, lead, manganese, mercury, vanadium or zinc or their derivatives; fumes from tar-works; cement-works fumes and odours from purification plants, glue

factories, cement-works and meat or fish processing factories; and any other gas, fumes or particular matter prescribed as noxious or offensive gas for the purposes of the Act; and includes dust from asbestos treatment or mining.

The scope of the Act extends only to controlled areas. Under Section 7, the Minister is entitled to declare any area to be a controlled area.

If the holder of a registration certificate fails to comply with the conditions the Air Pollution Control Officer may by notice in writing call upon such holder to comply with such conditions or requirement within a reasonable period specified in the notice, and in the event of his failure to comply with the said conditions or requirement within the period so specified the holder shall be guilty of an offence.

For the purpose of ensuring that any conditions or requirements imposed by or under the Act are complied with or carried out the Air Pollution Control Officer is empowered to inspect, or order an inspector to inspect, any building or plant to which a registration certificate relates.

Commentary

This Act also establishes an elaborate administrative structure for its implementation and enforcement. The Minister is empowered to declare areas to be controlled areas and the Air Pollution Officers only act under the directions of the Minister. However, the Act is poorly implemented. There is no evidence for instance that the Air Control Officer submits a comprehensive report to the Minister who then lays it before the National Assembly, as required by Section 6 of the Act.

Under Section 14, the Minister is empowered to publish and disseminate information and cause educational programs related to the control of atmospheric pollution to be devised and carried out, yet this has not been done.

Once again, it will be seen mercury is mentioned in a cursory manner. In its current form the Act will not facilitate compliance with the Minamata Convention.

4.3 The Drugs and Related Substances Act

This applies to all drugs and related substances, including habit-forming drugs. In terms of the Act, "drug" means any substance or mixture of substances used or purporting to be suitable for use, or manufactured or sold for use in the diagnosis, treatment, alleviation, modification or prevention of disease, illness, abnormal physical or organic condition or the symptoms thereof, or restoring, correcting or modifying any somatic or psychic or organic condition, and shall include a related substance and, to the extent that it complies with the above definition, a habit-forming drug. A "habit-forming drug" means any drug, plant, preparation or substance, or mixture of substances, whether or not otherwise complying with the definition of drug, which is prescribed by the Minister to be a habit-forming drug, and in so prescribing the Minister may prescribe different categories of habit-forming drugs and any special conditions relating thereto.

The Act regulates the importation, manufacture, classification and dispensing, advertisement and labelling of drugs.

Administrative Institutions

The Act is administered by the Director of Health Services assisted by the Drugs Advisory Board established under Section 5.

Commentary

The Drugs and Related Substances Act controls and regulates medical drugs in Botswana. It sets up institutions with oversight powers. The Act ensures that chemicals are handled and managed to ensure safety. There is a fair measure of recording and administration. But once, again no specific focus on mercury.

4.4 The Radiation Act

According to Section 1, the Act applies to any person or body of persons whose undertaking involves or includes generally the use of atomic energy and nuclear technology and, in particular, the production, processing, handling, use, holding, possessing, storage, transport and disposal of natural and artificial radioactive materials and radiation devices in respect of any other activity which involves a risk or harm arising from radiation.

Institutional Administration

The Act establishes a Radiation Protection Board. The functions of the Board are to:

a) *advise the Minister with regard to all matters concerning atomic energy, nuclear science and related technologies;*

b) *authorize the peaceful use of atomic energy and nuclear technology and in particular the production, processing, handling, import, export, possession, storage, use, transport and disposal of radioactive materials and related substances;*

Under Section 18, the Act establishes the Radiation Protection Inspectorate, which consists of the Director, the Deputy Director and others. The function of the Inspectorate is to implement the decisions of the Board. The other functions of the Inspectorate are:

a) *carry out regulatory inspections;*

b) *develop safety principles and criteria for approval by the Board;*

Commentary

The institutional set up adopted by the Act is strong. The Act forms the Radiation Protection Board, a linkage to the Minister and the Inspectorate which implements the decisions of the Board.

The main weakness is that there are no regulations to operationalize the Act.

Once again it will be noted that the Act is not focused on use and Management of mercury.

4.5 The Waste Management Act

The purpose of the Waste Management Act is to provide for the establishment of the Department of Sanitation and Waste Management (now called the Department of Waste Management and Pollution Control); for the planning, facilitation and implementation of advanced systems for regulating the management of controlled waste in order to prevent harm to human, animal and plant life; to minimize pollution of the environment, to conserve natural resources; to cause the provisions of the Basel Convention o apply in regulating the trans-boundary movement of the hazardous wastes and their disposal. Section 45 domesticates the Basel Convention.

The Scope of the Act

The Act applies to controlled waste. Controlled waste includes the waste defined as household, industrial, commercial, and clinical or hazardous waste. Hazardous waste is defined as controlled waste which has the potential, even in low concentrations, to have significant adverse effect on public health or the environment on account of its inherent chemical and physical characteristics, such as toxic, ignitable, corrosive, carcinogenic or other properties

Administrative Institutions

Section 3 of the Act establishes the Department of Sanitation and Waste Management. Section 4 of the Act also establishes the office of a Director, who is responsible for the administration of the Department.

Under Section 14(2) of the Act no person is permitted to operate a waste disposal site unless the waste disposal site is registered. Further, no person is required to manage controlled waste on or upon any land or other premises without a waste management facility license.

Commentary

The Waste Management Act establishes an administrative institution, the Department of Sanitation and Waste Management (now Department of Waste Management and Pollution Control), headed by the Director.

The scope of the Act is very wide and applies to almost all types of waste. It regulates the disposal of chemical waste, its movement and the persons entitled to handle it. The Act imposes both criminal and civil liability for contravention of its provisions. The Act also incorporates the Basel Convention, making it part of the national law. However, the Minister has not yet promulgated regulations to operationalize some aspects of the Basel Convention. The administrative structure set up for the implementation of the Act is quite active and effective. The greatest challenge is to incorporate compliance with obligations imposed by international agreements such as the Stockholm Convention. Use and Management of mercury would also fall under this Act but lack of focus would not facilitate implementation of the Minamata convention.

4.6 The Agrochemicals Act

The purpose of the Agrochemical Act is to provide for the registration and licensing of agrochemical, to control or regulate their importation, manufacture, distribution, use and disposal, so as to prevent pollution to the environment or harm to human, plant or animal life.

The Scope of the Act

Agrochemical is defined as any organic, inorganic or live biological material intended or offered for sale for purposes of destruction, control, repulsion, attraction or prevention of any undesirable life forms injurious to plant and animal growth or promotion or inhibition of plant growth such as fertilisers, growth regulators, hormones, defoliants or legume inoculants.

Regulation 9 requires licensees to keep record concerning the importation, manufacture, distribution or sale of an agrochemical maintained in accordance with section 28 of the Act.

Regulation 12 deals with disposal of waste. It prohibits any person from dumping an agrochemical container indiscriminately; or put an agrochemical into food containers. A licensee is required to ensure that cartons, boxes and bags used to carry an agrochemical are shredded to avoid re-

Commentary

The Agrochemicals Act establishes an oversight and administrative institution for its implementation. Another positive element about the Act is that it provides for labelling requirements and contains provisions of how agrochemicals must be handled at work. The absence of a common standard presents a challenge. However, SADC has adopted a GHS standard which member countries are obliged to adopt. The Botswana Bureau of Standards (BOBs), is the focal point for implementation of the standard. Once fully established the GHS standard should finally address the challenges of labeling. Again, use and management of mercury as contemplated by the Minamata Convention is not met.

4.7 Public Health Act

The purpose of the Public Health Act is expressed in its preamble as to make the notification of certain diseases compulsory and to control such diseases; to make provision regarding diseases subject to the International Health Regulations; to prevent the spread of smallpox; to prevent the introduction of diseases into Botswana; to regulate sanitation and housing; to provide for the protection of foodstuffs and of water supplies; to regulate the use of cemeteries; and generally to make provision for public health.

Commentary

Section 82 brings in the relevance of chemical management. Otherwise the Act largely deals with issues of disease control. Again, it falls short of meeting Minamata Convention requirements.

4.8 Factories Act

This Act applies to factories belonging to or in the occupation of the Government and to building operations and works of engineering construction undertaken by or on behalf of the Government, and to the employment by or under the Government of persons engaged in painting or renovating buildings.

Commentary

The Act is concerned with health and Safety of workmen. It enjoins employers to ensure a safe working environment for workers. Exposure to chemicals is one hazard which employees may be exposed to and the Act seeks to provide a measure of protection. The government has set up the Department of Health and Safety and appointed inspectors to enforce the Act. The Act is far inadequate for implementation of the Minamata Convention.

4.9 Obligations from the Basel Convention

The Basel Convention was adopted in 1989. The Convention is an international reaction to concerns about hazardous and toxic waste from developed countries being dumped in developing countries.

Obligation to Establish Legal, Administrative or Other Measures

Article 4(4) of the Convention provides that:

> *''Each Party shall take appropriate legal, administrative and other measures to implement and enforce the provisions of this Convention, including measures to prevent and punish conduct in contravention of the Convention."*

Compliance Notes

As one of the measures to implement the Basel Convention, as required by Article 4(4), Botswana has incorporated the Basel Convention in its Waste Management Act. This means the Convention forms part of the domestic law of Botswana.

The Act could be deemed to complement the Minamata Convention for it has provisions that could facilitate aspects of the Minamata Convention.

4.10 Obligations from the Rotterdam Convention

Each party has an obligation to designate one or more national authorities that shall be authorized to act on its behalf in the performance of the administrative functions required by this Convention. Parties have an obligation to ensure that such authority or authorities have sufficient resources to perform their tasks effectively and to take such measures as may be necessary to establish and strengthen their national infrastructures and institutions for the effective implementation of this Convention.

Compliance Notes

According to the Rotterdam Convention website, Botswana has designated national authorities and notified them to the Secretariat. Again, this Act is more complementary but cannot be used as a vehicle for implementation of Minamata convention.

The Table 2 below presents an overview of the legislative tools that Botswana has for chemicals management and measures that need to be taken to ensure they also cover mercury in their scope and or operation. It is apparent from the review that most of the legislative tools that the country has, while broad, were not designed to focus on mercury only let alone to honour international obligations under the Minamata Convention which at the time of their promulgation did not exist. This inevitably means there are gaps which need to be filled to ensure compliance with the Minamata Convention

Table 25: Legal measures that are applicable to the Minamata convention

Article 3	
Description of Article**: Mercury supply sources and trade**	
Succinct summary of provisions relevant to the country in question	• *not allow new primary mercury mining* • *Obtain information on stocks of Mercury compounds exceeding 50 metric tons (MT), and Mercury supply generating stocks exceeding 10 MT/yr.* • *Not allow the export of Mercury unless the importing country provides written consent.* • *Not allow 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.	
Title and reference/number of relevant policy and Regulatory measure, as well date. Mines and Minerals Act. Cap. 66:01 The Explosives Act 1962. Chap. 24:02	*a) Not allow new primary Mercury mining: The Mines and Minerals Act provides for the granting, renewal and termination of mineral concessions. Mercury is not specifically mentioned in the Act but can be classified under section 2 as a mineral. There is no restrictions on mercury and use in ASGM referred to in the Act. Under Section 4(a) of the Explosives Act, President is empowered to make various regulations - prohibiting or regulating the importation and transit of explosives;* • *regulating the transport and storage of explosive* • *Legislation fragmented and none focuses on mercury.*
Outstanding regulatory policy aspects that would need to be addressed/developed to ensure compliance with the Convention.	
• ***There is no legislation prohibiting new primary Mercury mining, no legislation prohibiting export of Mercury unless the importing country provides written consent, legislation prohibiting importation of Mercury without government consent, ensuring both the Mercury source and proposed use are allowed under the Convention. At the moment there is no specific piece of legislation that deals with use and management of mercury aimed at compliance with MINAMATA Convention. Mercury is mentioned in a cursory manner in the Acts. In fact, all the Acts predate the MINIMATA Convention and therefore whatever is said about mercury in these Acts did not envisage the MINAMATA Convention.*** • ***It is therefore, necessary that an Act specifically focused on use and Management of Mercury be enacted.*** • ***It is recommended that an overarching Environmental Act be promulgated, that will deal with end – to - end treatment of mercury and mercury products in context of supplies and trade I mercury and mercury compounds, importation, transportation, storage, use and disposal of mercury.***	

- ***The overarching Act must provide for a streamline definition of mercury compounds in line with the MINAMATA Convention***

Article 4	
Description of Article**: Mercury – added products**	
Succinct summary of provisions relevant to country in question. Botswana National Trade Policy of 2009	• *Not allow the manufacture, import of products listed in Part I of Annex A not otherwise excluded following the phase out date listed in the Annex* • *Phase down the use of dental amalgam through two or more measures listed in Part II of Annex A* • *Take measure to prevent the incorporation of the products listed in Part I of Annex A (i.e. switches and relays, batteries) in to larger, assembled products* • *Discourage the manufacture and distribution of new mercury product types.*
Policy and regulatory measures in place to enable the country to comply with the above listed provisions:	
Botswana National Trade Policy of 2009	• *Botswana National Trade Policy of 2009 does not provide a specific list of products to be exported and imported.* • *Botswana imports some MAPs such as mercury oxide batteries, fluorescent lamps, switches and relays, etc. it is unclear as to whether the content threshold specified in the Convention are exceeded or not.*
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Conventions	
There is no legislation in place which: • ***Prohibits the manufacture, import, and export of products listed in Part I of Annex A of the Convention, that are not otherwise allowed as per Annex A of the Conventions;*** • ***Phases down the use of dental amalgam through two or more measures listed in Part II of Annex A,; and*** • ***Discourages the manufacture and distribution of new mercury product types which are without demonstrated environmental or health benefits;*** • ***Botswana does not manufacture many of the listed MAPs but may have to focus on reduction of imported MAPs*** • ***Build upon the Trade Policy and integrate measures for restricting export and import of Annex A MAPs.*** • ***It is recommended that an overarching Environmental Act be promulgated, that will deal with end – to - end treatment of mercury and mercury products in context of supplies and trade I mercury and mercury compounds, importation, transportation, storage, use and disposal of mercury.*** **The overarching Act must**	
Article 5	
Description of Article: **Manufacturing process in which mercury or mercury compounds are used.**	

Succinct summary of provisions relevant to the country. Atmospheric Pollution (Prevention) Act, 1971. Chap. 65:03	• *Restrict (as specified in the Annex) the use of mercury in the processes listed in Annex B, except facilities using mercury catalysts to produce polyurethane* • *For facilities with process listed in Annex B, identify and obtain information on mercury compound use* • *Control mercury emission to air, and releases to land and water* • *Discourage new use of mercury in industrial processes.*
Policy and regulatory measures in place that enable the country to comply with the above listed provisions:	
Title and reference/number of relevant policy and Regulatory measure, as well date. Atmospheric Pollution (Prevention) Act, 1971. Chap. 65:03	• *Botswana does not have plants using Mercury in the processes listed above, but it will take action to prohibit any likely mercury use in any industrial processes.* • *The Act provides for the prevention of pollution of the atmosphere and protection of the public from adverse effects of emissions. – sections 2, 7, 8 and 9* • *Promulgate the overarching Environmental legislation to facilitate implementation*
Outstanding regulatory or policy that would need to be addressed/developed to ensure compliance with the Convention's provisions (only in relation to binding provisions)	
Not allowing new facilities from using mercury in the processes listed in Annex B, except facilities using mercury catalysts to produce polyurethane: for facilities with processes listed in Annex B, identifying and obtaining information on mercury or mercury compounds use and controlling of mercury emissions to air and releases to land and water from such facilities: and Discouraging new uses of mercury in industrial processes**. There is no legislation in place which controls these activities.** • ***Expedite the promulgation of an overarching Environmental Act to facilitate implementation*** • ***Make specific regulation on mercury and mercury compounds under the envisaged overarching Environmental Act.*** • ***Develop air quality standard with provisions on mercury***	
Article 6	
Description of the Article**: Exemptions available to a party upon request**	
Succinct summary of provisions relevant to the country in question. None	Register for one or more exemptions from the phase out date listed in Annex A.
Policy and regulatory measures in place to enable the country to comply with the above listed provisions:	
No policy	No legislation or policy to address the above Register for exemptions for MAPs under Part 1 Annex A
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions (only in relation to binding provisions)	

Pass Register for exemptions for MAPs under Part I Annex A	
Article 8	
Description of Article: **Emissions**	
Succinct summary of provisions relevant to the country in question. None	• *Eliminate use of mercury* • *Reduce mercury emissions into air land and water*
Policy and regulatory measures in place to enable the country to comply with the above listed provisions:	
Title and reference/number of relevant policy and regulatory measures, as well as date: None	Botswana does not have ASGMs
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions (only in relation to binding provisions)	
(select from the below as appropriate to national situation) • ***Require one or more measures identified in Article 8.5 t control/reduce mercury emissions from existing sources*** • ***Require monitoring/reporting and otherwise establish a mercury inventory for sources listed in Annex D*** • ***Identify if these sources are available in the country. E.g. Coal- fired power plants, coal fired industrial boilers, non – ferrous metal smelting and roasting processed*** • ***Public Health Act 11 of 2003 does not have adequate provisions for treatment of mercury.*** **Botswana has a standard for ambient air quality – limits for common pollutants (BOS 498:2012). However, mercury and its compounds are not included in the list of identified common air pollutants.**	
Article 9	
Description the Article: **Releases**	
Succinct summary of provisions relevant to the country in question. None	• *Require reporting or otherwise obtain information as needed to identify significant sources of mercury/mercury compound releases to land or water and to land or water and to maintain an inventory of releases from the sources identified.* • *Take one or more measures specified in Article 9.5 to control/reduce mercury and mercury compound releases to land and water significant sources it identifies.*
Policy and regulatory measures in place to enable the country to comply with the above listed provisions	
Title and reference/number of relevant policy and regulatory measures, as well as date: None	**Require one or more measures identified in Article 9.5 to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies:** • *The Waste Management strategy (BWMS) has identified some pollutants to the environment but is not specific to mercury.* • *The Waste Management Act 15 of 1998 while providing for collection of waste does not provide for mercury and its handling and disposal*

Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions (only in relation to binding provisions): ***Pass overarching Environmental law and provide for standards.***	
Take measures to ensure interim mercury storage is conducted in a environmentally sound manner, taking into account guidelines to be developed by the Conference of the Parties (COP)	
Article 10	
Description of Article**: Environmentally sound interim storage of mercury and other mercury waste**	
Succinct summary of provisions relevant to the country in question. None	Take measures to ensure interim storage of mercury is conducted in an environmentally sound manner, taking into account guidelines to be developed by the Conference of the Parties (COP)
Policy and regulatory measures in place to enable the country to comply with the above listed provisions	
Title and reference/number of relevant policy and regulatory measures, as well as date: None	No National policy/guideline or legislation in place
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions (only in relation to binding provisions	
Pass over arching Environmental law to address gaps.	
Article 11	
Description of Article**: Mercury Waste**	
Succinct summary of provisions relevant to the country in question. None	• *Use a definition of mercury waste consistent with Article 11.2* • *Take measures to manage mercury wastes in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with the COP requirements to be developed* • *Take measures to restrict mercury derived from the treatment of re – use of mercury waste to allowed uses under the Convention or environmentally sound disposal* • *Require Transport across international boundaries in accordance with the Basel Convention, or if the Basel Convention does not apply, consistent with international rules, standards and guidelines*
Policy and regulatory measures in place to enable the country to comply with the above listed provisions	

Succinct summary of provisions relevant to the country in question	• ***Take measures to restrict mercury derived from the treatment of re – use of mercury waste to allowed uses under the Convention or environmentally sound disposal. :*** *Botswana is party to the Basel Convention and follows requirements for waste disposal – this include mercury. But there are no mercury disposal sites.* • *BWMS provides for management of waste including mercury related waste.*
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions (only in relation to binding provisions	
• ***Provide specific guidelines for collection, disposal and storage of mercury waste.*** • ***Review and update the BMWS to address specific waste issues (such as mercury waste management)***	
Article 12	
Description of Article: Contaminated sites	
Succinct summary of provisions relevant to the country in question	• *Develop strategies for identifying and assessing mercury/mercury compound contaminated sites* • *If risk reduction activities are taken at contaminated sites, they are taken in an environmentally sound manner, incorporating risk assessment where appropriate.*
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date	• *Access domestic resources as may be needed to implement Convention obligations* • *Access financial resources available under the Convention financial mechanism and other resources available from the multilateral, regional, and bilateral funding sources.*
At national level there is no guiding policy/strategy to address mercury contaminated sites and associated impacts. – No mercury contaminated site has been identified in Botswana.	
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions):	
• ***Develop regulations and strategies for the environmentally sound management of mercury contaminated sites as per the COP guidelines***	
Article 13	
Description of Article: **Financial Resources Mechanisms**	

Succinct summary of provisions relevant to the country in question. None	• *Article establishes financial mechanism with two components:* • *The Global Environmental Facility Trust Fund (GEF)* • *International Program to support capacity building and technical assistance.*
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date	• *Solicit funding through DWMPC* • *Involve private sector*
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions):	
Pass Environmental legislation that will domesticate the MC and provide regulations to facilitate sourcing of funds locally in Internationally.	
Article 14	
Description of Article: **Capacity – building, technical assistance and technology transfer**	
Succinct summary of provisions relevant to the country in question. None	• *Parties to cooperate in providing capacity* • *Parties to cooperate in providing technical assistance*
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date. None	**.** Botswana Waste Management Strategy provides for training and capacity building but it's under-utilized**.**
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions):	

• *Pass Overarching Environmental Legislation with appropriate provision and regulations dealing with mercury* • *Provide for institutional capacity building for implementation of MC i.e. Build Capacity with the DWMPC And other institutions relevant in management and use of mercury.*	
Article 16	
Description of Article: Health Aspects	
Succinct summary of provisions relevant to the country in question	• *Promote the development of strategies to identify and protect populations at risk, such as developing fish consumption guidelines* • *Promote occupational exposure educational and prevention programs* • *Promote prevention, treatment and care services for affected populations*
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date	• ***Promote occupational exposure educational and prevention programs:*** There is no specific policy that addresses mercury exposure. National Heal Policy covers broad health issues. Public Health Act deals with the powers of the national health council to handle issues of health. Section 5 and 11 of the Townships Act for provides for the powers of Cities and townships to promote health and safety. But they are not mercury specific.
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions):	
• ***Promote the development of strategies to identify and protect populations at risk, such as developing fish consumption guidelines*** • ***Promote occupational exposure educational and prevention programs*** • ***Promote prevention, treatment and care services for affected populations***	
There is no legislation enabling formulation of strategies to identify and protect populations at risk, promoting occupational exposure, educational and prevention programs in line with Article 2 which provides for promotion, prevention, treatment and care service for affected populations. • ***Pass law the overarching law to address these gaps both in substantive legislation and regulations***	
Article 17	
Description of Article**: Information Exchange**	
Succinct summary of provisions relevant to the country in question	Share information on the health and safety of humans and the environment as non – confidential, in accordance with Article 17.5

Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date	**Share information on the health and safety of humans and the environment as non – confidential** There is no information exchange strategies or guidelines for mercury and its compounds
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions):	
Pass overarching Environmental law with provisions and regulations on information sharing.	
Article 18	
Description of Article**: Public information, awareness and education**	
Succinct summary of provisions relevant to the country in question	• *Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released, or disposed.* • *Education, training and public awareness related the effects of exposure to mercury and mercury compounds on human health and the environment, in collaboration with relevant intergovernmental and NGOs and vulnerable populations as appropriate.*
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date	**Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released, or disposed**: Ministry basic Education and the Departmental of Environmental Affairs should coordinate the implementation of National Environmental Education. Integrate mercury.
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions):	

• *Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released, or disposed.* • *Education, training and public awareness related the effects of exposure to mercury and mercury compounds on human health and the environment, in collaboration with relevant intergovernmental and NGOs and vulnerable populations as appropriate.*	
• ***Pass Overarching Environmental legislation to address the gaps and make provision for collection, dissemination of information and or education and training to facilitate public awareness on exposure to mercury and mercury compounds*** • ***DWMPC to develop a stakeholder engagement and mercury awareness framework.***	
Article 19	
Description of Article**: Research, Development and monitoring**	
Succinct summary of provisions relevant to the country in question	To cooperate with other countries to develop and improve on key areas of research that can support effective implementation of the Convention. Research areas include, inter alia, inventories of mercury use and consumption: the level of mercury in aquatic foods sources, and information on mercury commerce and trade
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date	The regime of cooperation established under the Basel Convention could be utilized.
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions	
Pass the Environmental address to address gaps. Compliance the Convention need force of law to compel certain actions necessary for implementation.	
Article 21	
Description of Article**: Reporting**	
Succinct summary of provisions relevant to the country in question	Reporting to the COP on progress in implementation of Convention obligations under Article 21
Policy and regulatory measures in place that enable the country to comply with the above provision	

Title and reference/number of relevant policy and regulatory measures, as well as date	The DWPC to ensure timely reporting to the COP on the implementation of MC
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions	
Pass overarching Environmental legislation that not only domesticates the MC and regulations to facilitate implementation and reporting.	
Article 25	
Description of Article**: Settlement of disputes**	
Succinct summary of provisions relevant to the country in question	• *Participate in one of the dispute resolutions specified if needed under Article 25 of the MC in the course of implementation of the Convention. In case of dispute the MC lays down the following rules:* • *Countries shall seek to settle any dispute between them concerning the interpretation or application of the Convention through negotiations or other peaceful means of their own choice – Article 25.1* • *A country or a regional economic integration organization may declare at the time it ratifies the convention, or at any time thereafter , in a written instrument submitted to the Depositary that , with regard to any dispute concerning the interpretation or application of the convention, it recognizes one or both the following means of dispute settlement as compulsory in relation to any accepting the same obligations: a. Arbitration in accordance with the procedure set out in Part I of Annex E and b. submission of the dispute to the International Court of Justice – Article 25.2*
Policy and regulatory measures in place that enable the country to comply with the above provision	
Title and reference/number of relevant policy and regulatory measures, as well as date. None	Follow guidance of MC as stated above.
Outstanding regulatory or policy that would need to addressed to ensure compliance with the Convention's provisions (only in relation to binding provisions	
Pass Overarching Environmental legislation to provide certainty of route of dispute settlement adopted by Botswana.	

Chapter 5: Awareness Raising Strategy for the Botswana

Article 18 of the Minamata Convention focuses on information sharing between governments and the public. It identifies key information that governments need to share with the public and the mechanisms that can be employed for public awareness-raising.

Parties to the Convention are required, within their capabilities to promote and facilitate information on the following:

A:

a) The health and environmental effects of mercury and mercury compounds
b) Alternatives to mercury and mercury compounds
c) The topics identified in Article 17 which deals with ASGM
d) The results of its research, development and monitoring activities under Article 19; e) Activities to meet its obligations under the Minamata convention

B:

Education, training and public awareness related to the effects of exposure to mercury and mercury compounds on human health and the environment, in collaboration with relevant intergovernmental and NGOs and vulnerable populations, as appropriate.

Thus, the mandate for education, training, and public awareness (Article 18) encourages collaborations with NGOs and vulnerable populations, therefore the Convention anticipates that the governments must take steps to identify NGO stakeholders and vulnerable populations and include them in the awareness strategy. Also take preventative measures in order to protect against mercury exposure by providing public statements including advisories and precautionary warnings.

The Minamata Conventions stems from the fact that the toxicity of mercury for human health has long been known, and the toxic effects of different forms of mercury have been extremely studied. Some of these are that elemental and methylmercury are toxic to the central and peripheral nervous system, inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems. Damage to the lungs and kidneys may be fatal, and inorganic salts of mercury are corrosive to the skin. Mercury can also have effects on eyes and gastrointestinal tract.

5.1 Purpose of Awareness Raising

Awareness raising is about informing and educating people about topics, issues or matters pertinent to their lives with the intention of influencing their attitude, behaviour and believes towards the achievement of a defined purpose or goal. Thus, in this case, mercury awareness raising will be aimed at informing and educating people about mercury and the effects of the exposure to mercury and mercury compounds in order to influence their attitudes, behaviours, believe and conduct regarding this substance and all its products because of the impact that it has on both human health and the environment.

Awareness raising must always be purposeful. Some of the reasons for awareness raising may include to influence, persuade, notify, inform, correct behaviour, educate, disseminate information and uplift the beneficiaries towards a defined outcome regarding the subject of the awareness raising. As a purposeful act, there is a positive outcome which is expected after awareness raising.

5.2 Language

One of the difficulties especially in African countries is the fact that the government business is usually conducted in a foreign language, usually English, French, Spanish or Portuguese depending on the colonial history of a country. While such a language may be a medium of communication for government business perhaps including as a language of instruction in schools, there are usually many people in a country, especially the poor who may not comprehend it. This creates disenfranchisement. It becomes a language of the elites unfortunately dealing with matters of public policy that affect every citizen.

Going together with this is the fact that the environmental conventions are written in English in countries such as Botswana and have a lot of content which is not easily translatable into the local languages even if an effort is made. The challenge arises from the fact that the vocabulary of these local languages is limited and, in many cases, not suited to scientific content that needs to be communicated by these conventions.

When an effort is made to communicate the message of these conventions in local languages, there is then a tendency to use terminology that is considered closer to what is intended many times distorting the message. The unintended consequence of that is that the illiterate populace in such a country end up with a different understanding of what the convention is all about and what its implications might be to them.

In some cases, those who undertake awareness raising faced with this language dilemma simply use the English and scientific concepts as they stand regardless of whether the beneficiaries comprehend the message. Usually in a case like that the end result is that the message is lost, and the awareness is largely not achieved. This quandary is what technocrats and NGOs in African countries face all the time. It may not be unreasonable to postulate that faced with this communication failure communities in these countries fail to see themselves in what is being communicated relegating it to the realm of elites. And when that occurs, the desired change in attitude and behaviour is not achieved, putting people who are largely vulnerable at risk.

The other issue is that the people who play a role in the awareness raising campaigns may themselves not possess proficient language skills to accurately translate the information from English into their local languages. Quite often this is done by scientists and not linguists.

5.3 Low literacy

While there are many schools in Africa, the literacy levels remain low. There are many people who still cannot read and write and there are equally many who have attended school but do not possess functional literacy. Given this situation, understanding highly complex science-based conventions remains highly elusive. Scientific concepts such as mercury or mercury added products or emissions, or releases are foreign and difficult to understand. Many times, these people are not able to understand their individual contribution to a complex problem such a mercury pollution and mercury in processes and products.

5.4 Urban - rural divide

The majority of people in African countries live in the rural areas and Botswana is no exception. Rural areas are generally characterized by poor living conditions, high poverty and lack of modern-day life amenities that other citizens who live in the urban areas enjoy. Some of these amenities that are

lacking include roads, communication infrastructure, well equipped schools, electricity, potable water, connectivity with the rest of the world, etc. But these people contribute to global problems as well and as citizens they have a right to information just like their urban counterparts. In some respects, they may be even be more entitled to accurate and up-to-date information more than their other fellow citizens because of the way they derive their livelihoods which pre-disposes them to danger disproportionately.

Yet again the difficulty is lack of infrastructure and capacity to effectively reach them. This condition presents a huge challenge, which must be overcome. There are no easy solutions and most of the efforts to-date remain insufficient. The vast majority of the rural people remain out of reach and continue to suffer the impacts in silence and ignorance largely unrecognised and only vicariously considered.

5.5 Digital divide

Many people in African countries are not fully connected to latest methods of communication. They have a radio, yet even the radio may not reach some of the rural areas. Some may have mobile phones mostly used for making and receiving calls only. Many have no computers nor access to computers and unsurprisingly many have not touched a computer in their lives including in schools. The vast majority of schools do not have computers and as such do not teach any IT courses or subjects.

Because of this, rural people rely on old methods of communication when the world is moving towards a roll out of the 5G technology and the fourth industrial revolution. They are left behind. Internet is Africa is still patchy and very expensive. And because most people do not have access to the internet, the vast resources that are easily available to the rest of the world on the internet are not accessible to them.

Some effort may be made to use these latest technologies to disseminate information and raise awareness, but it needs to be understood that such methods leave many out. Regrettably, in some cases they leave out the most vulnerable in these societies. Simple and relatively old technologies like TV still remain unavailable to the vast majority. Some of the causes for this include a mere fact that such areas are not connected to electricity and many do not even seem close to being connected.

Even when electricity is available, another factor, is affordability of this technology. TV connection is very expensive, monthly subscriptions are too high and maintenance support is unavailable in the rural areas. People have to travel long distances even for the smallest problem.

5.6 Gender

Although many efforts are being made to push for gender equality in Africa, the reality on the ground indicates that the continent still has a long way to go to achieve this goal. Laws are being amended and new laws are being enacted to address the status of women yet the central challenge that carries this behaviour forward is the cultural repertoire that subordinates women within these countries. Generally, women are regarded as minors whose existence within the families is tightly woven onto the male figures in their families. Major decisions within the families remain the prerogative of the males with women primarily playing a support role. This status of women in most African countries is so ordinate that it defines the fabric of society and is equivocally accepted by both men and women alike.

It is rooted in the culture of the people. It continues to be handed down from one generation to the other. In its manifestation, it is essentially both private and social with its natural habitat as the household. From the household, it then radiates to the community and then the country. It is a social construct that represents a people's reservoir of what defines them and represents their existential connection since time immemorial.

Rural women in particular face the greatest challenge given the conditions within which they live. For many of them educational levels are low, necessities such as water are lacking, healthcare facilities are difficult to access and incomes are largely non-existent with many depended on males within the families and subsistence agriculture. It is the men who leave homes in search of job opportunities elsewhere while women remain with the children. Men are therefore seen as providers commanding levers of household and community economy while women are caregivers. This puts men at a higher level than women, a position of privileges and power.

5.7 Age divide

The generational gaps and norms are widening all over the world. The younger generations are more digitally oriented than the older ones. Additionally, the roles and decisions taken by different generations seem to have different degree of impacts to national development. Young people still have little say, yet they are more in numbers especially in the developing countries. Their participation in decision making at the household level is poor to non-existent. And at the national level, they mostly rally behind older people with limited opportunity to articulate their own aspirations. Many times, they are referred to as the future, yet the future and the direction it takes so spoken about reside in the hands of the old generation.

5.8 Strategic Objectives

1. To provide a strategic framework for education, training, awareness raising and community outreach on mercury in the country
2. To provide a vehicle for information sharing and skills transfer in the country
3. To provide a vehicle for stakeholder collaboration and engagement in the country
4. To provide a strategy for resource mobilization for awareness raising, education and training activities for Minamata issues in the country

5.9 National Policies/Instruments Meant to Address Awareness in Botswana

5.9.1 Vision 2016

In 2016 Botswana developed its Long-Term vision "Towards a Prosperity for All". Some of the dreams and aspiration the country outlined in the Vision 2016 are to be an educated and informed nation; this put emphasis on the quality of education offered and accessibility. Further the Vision calls for improved access to information as well as its dissemination with emphasis on fully developed communication capacities particularly the electronic media and broadcast media.

5.9.2 National Vision 2036

National Vision 2036 defines Botswana's aspirations and aims to spur Botswana towards a high-income status by 2036. It is premised on the principles and pillars of sustainable development, enabling Botswana to build resilience as it pursues its development agenda.

The National Vision 2036, however, does not have specific strategies or targets for implementation of the Minamata Convention. It however sets the tones of what the county strife for future sustainable growth. Therefore, strategies for the implementation of the Minamata Convection should be linked with the country's overall objectives for a transformative society.

5.9.3 National Development Plan

The National Development Plan (NDP11) is the current planning framework for the country's development, under the theme "**Inclusive Growth for the Realisation of Sustainable Employment Creation and Poverty Eradication".**

NDP 11 is closely aligned to the National Vision 2036 which outlines the aspirations and goals for the country to move from a middle-income country to a high-income country by 2036, within the sustainable environment thematic area. The NDP recognises that sound management of chemicals and waste is essential for sustainable health (human and environment) and therefore calls for the following initiatives that are relevant for mercury management.

A Healthy Environment for Healthy Population-emphasis is placed on implementation of the measures to address environmental health risks that are mainly due to poor waste management and air pollution.

Clean Air Programme-development of air pollution control policy and regulatory frameworks, development of standards, air quality monitoring technology, public education and awareness as well as maintenance and development of monitoring technology and infrastructure.

Chemicals and Waste Management- NDP 11 recognises the need to put in place efficient management practices for handling chemicals. Therefore, chemical management systems will be developed to reduce associated risks and impacts of chemical exposure.

5.9.4 National Environmental Education Strategy and Action Plan

In 1997, the National Conservation Strategy (NCS) developed the National Environmental Education Strategy and Action Plan (NEESAP) to drive the efforts of awareness building and education amongst the general public. The NEESAP implementation involves a wide range of stakeholders both within and outside government. The strategy and action plan promote formal and non-formal education on issues relating to the environment in general.

The NEESAP is a 5-year strategy aimed at increased environmental awareness through attitudinal change, readiness to learn, opportunities to share experiences and recognition of traditional systems of managing natural resources.

The NEESAP was reviewed in 2006 and ended in 2007, the revised NEESAP was aligned to a key development initiative, among them the national vision 2016 and the Millennium Development Goals (MDG). The revised plan aims to widen scope and raise awareness on the importance of environmental education among people and in greater importance of sustainable development.

Various institutions also undertake public awareness raising on a wide range of environmental issues including chemicals management as in the case of the Ministry of Agriculture and Food Security under the Department of Plant Protection on pesticides handling. The above department offer a weeklong course on the management of agrochemicals to all sectors engaged in the manufacture, sale, distribution, handling and use of agrochemicals.

5.9.5 Revised National Policy on Education

In 1994 the government of Botswana adopted the Revised National Policy on Education (RNPE) within which there was recommendation for the introduction of environmental education in school's curricula to promote awareness and education on issues of the environment to schools. As a result of this Policy, environmental education is now being taught as a subject at primary and secondary schools' levels. This gives an opportunity for issues on Mercury and other environmental issues to be taught at an early age to help in building a conscious and friendly nation.

The recommendations of the RNPE have been selectively been implemented, it has never been properly implemented, monitored and evaluated.

5.9.6 Transformation of the Education System

The Botswana Government through the Ministry of education and skills Development translated and adopted the Millennium Development Goals through sustainable universal access to all equally for both boys and girls (Botswana Millennium Goals, 2010). According to the same report, key dimensions of educational performance, e.g., enrolment, adult literacy, school infrastructure, basic equipment, supply of teaching materials and teacher qualifications have improved markedly since independence.

However, despite of this efforts by government, the level of awareness is still low among communities living around industries, fish dependent communities, consumers of cosmetics that contain mercury, health professionals, especially those in the dentistry, managers of school laboratories, members of the civil society as well as policy makers.

Information on mercury is still insufficient. In Botswana Public schools and health facilities are not equipped to manage and handle mercury. Most people who handle and encounter mercury still lack the general knowledge about the environmental and human health impacts of mercury and schools' laboratories are not adequately equipped to manage mercury spills or breakage of mercury containing products. Through training and curriculum development, public schools could act as conduits for public awareness raising in Botswana.

Public education and awareness raising needs the role and participation of the civil society, media and other such bodies like the Unions, traditional healer's associations, and Chamber of Mines, farmers and traders to ensure its effectiveness.

Botswana acknowledges that the effects of mercury on the environment and human health have been widely documented and the fact that mercury pollution from anthropogenic sources accumulates at a global level, in food sources, water bodies and the environment. The anthropogenic sources impact negatively on the ecosystem livelihood, and sometimes results in death. As party to the Minamata Convention, the country is committed to contributing to a solution to mercury emissions and releases, starting with awareness raising on mercury and mercury-containing products.

The country is currently undertaking a complete MIA study which will document in a comprehensive manner the sources of mercury in the country and the extent of each of the sources. This awareness raising strategy is one of the outputs of that process. And as indicated it is meant to address the outreach component of the Minamata convention implementation.

Table 26: The various products that contain mercury and their potential users in Botswana

Types of Products	Potential users
Batteries	General public, battery traders
Switches and Relays	Power utilities, power industry
Lamps (CFL and FFLs)	Households and general public
Lamps (HPMVs)	Local authorities, general public and power generating companies
Lamps (CCFLs and EEFLs)	Power industries and utilities
Certain Mercury Containing cosmetics, skin bleach	Skin lightening products users, women, retailers and all cosmetic/make up users
Pesticides, Biocides and Tropical Antiseptics	Farmers, agricultural workers, general public
Electronic/ electrical measuring devices	Hospitals, physicians, dental facilities and meteorological services plus calibrations facilities
Coal fired Power Plants	Botswana power utility
Coal fired industrial Boilers	Power utilities and factories
Waste incineration	Hospitals and local authorities

5.10 Information Dissemination Strategy

There are varied ways of dissemination of information. In general, the dissemination of information is associated with spreading, circulation, rolling-out, storage, transfer of or process of communicating information. Information referred to could be issues such as, speeches, broadcasting/voice, news, public exposure, publications, research, policy, directives, ideas, and awareness on mercury, as well as lessons learnt.

The Department of Waste Management and Pollution Control should use an array of strategies to disseminate information to its stakeholders. This includes regular profiling exercises to keep abreast with evolving needs of the various stakeholders, developing appropriate technology, adopting a differentiation approach to mercury and other hazardous waste, in responds to the needs of various stakeholders. The department should optimise the use of the portals, website, intranet, social media platforms, information resource centre, email, workshops and seminars including events and fairs, press release and newspapers.

5.10.1 Target Groups of the Awareness Raising and Training Initiatives

In order to achieve sound management and the elimination of mercury emissions and releases, it is necessary to strengthen institutional capacity, build up the capacity of professional officers to conduct field interventions and raise the awareness of affected and vulnerable communities about mercury risks; and provide training on mercury-free processes in order to prevent the release of mercury, reduce environmental pollution, and reduce or eliminate risks associated with community and industry practices.

Table 27 shows the target groups and their role in Awareness and Training in the Reduction of Mercury Products and Releases. All environmentally inclined government ministries, NGOs, industry and goods/products importers concerned should be included in the Awareness strategy, which forms part of the initial implementation of the Minamata Convention.

Table 27: Target groups for awareness raising for implementation of Minamata convention

Target Group	Role in the Minamata convention implementation
Vulnerable Communities (Women, Girls, indigenous people, miners and mining Communities)	Significant role in mercury exposure/reduction strategies and technological interventions, etc.
Community leaders and local government from vulnerable areas	Assist with development and implementation of plan within vulnerable communities

Indigenous groups	Represent indigenous interests from mercury-related operations in indigenous people's areas
Technical experts in gold mining, hazardous waste handling, and manufacturing and trade of mercury-containing products	- Provide understanding of technical alternatives to mercury use - Provide training opportunities
Environmental and human health organizations	Represent public interests in reducing environmental impacts of mercury products and the risks of exposure to the public
Human rights groups	Monitor actions from the perspective of human rights issues with regard to health, gender and children and indigenous people's rights, etc.
Academic and research Organizations	- Provide valuable information and conduct future research, including on effectiveness of measures taken to reduce or eliminate mercury use in different sectors - Provide training opportunities - Research and development of mercury-free methods
Fishing communities	Contribute to finding innovative solutions and provide insights on fishing
Other relevant land holders	Represent interest in land conflicts and in reclaiming impacted lands; risk of mercury exposure
Mercury-containing products traders	- Provide insight into market dynamics, and barriers to formalization - Important focal point for community health and emissions
Waste management specialists	Provide insight into available mechanisms to handle mercury wastes generated by different stakeholders
Private sector	- Technical capacity - Potential public/private partnership
Development organizations, including international NGOs, UN agencies, and bilateral aid agencies	May provide assistance with health, safety, environmental, business development or other aspects.
Media and communication groups	Effective communication, awareness raising, information dissemination

Women groups	- Issues unique to women including pregnancy and raising children - Specific impact of mercury on women and children
Traditional healers	Avoidance of mercury and mercury added products use in their practices

5.10.2 Ministry of Basic Education (MBE)

The Ministry of Basic Education currently has no strategy, policies in place for the handling of mercury containing product, though it provides education at secondary school level and an all schools have a fully equipped laboratory equipment and some have full time employed laboratory assistants. Teachers, students and laboratory assistants are exposed to mercury pollution as some of the schools have been in existence as far back as the 1950's and their stockpiles of chemicals including thermometers are still in place. It should also be noted that there have been incidents where students have broken into school's laboratories and stole some chemicals and use them as drugs, this has resulted in death, blindness and disability. Though it was not proved that mercury was used, we cannot rule out the possibility.

In its role of establishing national curriculum, MBE should include mercury education in science curriculum throughout the country to raise awareness on the use and hazards of mercury.

5.10.3 Ministry of Youth and Sports and Culture

Most of the shopping malls have hotspots where the public can access internet freely as a gesture from government to have citizens have access everywhere. In this hotspot the NOW TV which is an initiative of MYSC can also be view. This TV programme broadcast mostly youth content and government programmes meant to benefit the youth especially funding. This forum can be used to implement programmes and information on mercury.

5.10.4 Botswana Dental Association (BODEA)

The association holds regular meetings to update dentists around the country on new and improved practices and technologies in the dental field. All dentists are obliged to be members of BODEA. The Department of Waste Management and Pollution can develop an outreach and awareness programme tailored for dentists and their patients. Posters, brochures and electronic adverts can be placed in public, private dental practices and hospitals and clinics for information dissemination on mercury

5.10.5 Decision Makers

The ability of awareness raising programmes to reach, and influence decision makers is critical as is the starting point for the implementation of the Minamata convention requirements. this is also important as decision makers will ensure availability of resources. Decision makers to be targeted include political leaders (members of parliament, especially the Portfolio Committee on Wildlife,

Tourism, Natural Resources, and Climate Change, members of the *Ntlo-ya-Dikgosi*, Land Board members, District Health Management Teams(DHMT) in the Ministry of Health and Awareness, District Administrators, Councillors, Government Officials and the Private sector. Especially the mining sector as it is the second highest employer in Botswana.

5.10.6 Health Management Teams (DHMT)

The Ministry of Health and Wellness provides primary health care services through District Health Management Teams (DHMTs), DHMTs are responsible for running a network of health facilities, hospitals, clinics, health posts and mobile stops as well as community-based preventative and promote services. Through electronic data documentation, posters, brochures and other instruments used to raise awareness on mercury, DHMTs will be the most efficient instrument disseminate information on mercury as they reach out to the most remote areas in Botswana. They are also in regular contact with village leadership such as *Dikgosi*, Village Development Committee (VDC) Village Health Committees who easily draw the community to their meetings.

5.10.7 Non-Governmental Organisations (NGOs)

Non-governmental Organisations and Community-Based Organisations in Botswana are affiliated to two major organisations namely BOCONGO (Botswana Council of Non-Governmental Organisation) and BOCOBONET (Botswana Community Based Organisation Network) respectively. These are the umbrella bodies that keep databases concerning networking and information dissemination, capacity building ad training and providing an enabling environment for affiliates.

Non-governmental Organisation can disseminate and awareness information on Mercury in two ways; direct involvement by those organisations that have hands on activities that concern application of chemicals on their projects, storage or sale. Indirect involvement concerns those organisations that offer public awareness and theoretical research on the field of Mercury and other chemicals. NGO's are important in disseminating information because they seek gaps where the can play a significant role in addressing community needs.

There are however a number of NGOs that are not affiliated to BOCONGO or BOCONET but can be used for awareness and information dissemination on mercury through their programmes.

Table 28: Relevant NGOs that Infuse Mercury Awareness in their Programmes

Name of NGO	Relevant Activities	Outreach Programmes	Comment
Bocongo	Capacity of training for NGO,s sector for sustained development and service provision	Research, publication and documentation, networking and records of NGO,s for information dissemination	Capacity to conduct research on subject matter and training to its affiliates

Bocobonet	Capacity building for CBO,s sector for sustained development and service provision	Networking and research for CBO,s for information dissemination	Useful for information dissemination and extension of geographic coverage across the country and provide training to CBOs
Somarelang Tikologo	Demonstrations with Organic garden, creates awareness on alternatives to use of chemicals.	Environmental campaigns, Public awareness and Research and advocacy	It has the capacity to do research, carry out public awareness and educational activities.
Tshole Trust	Waste oil collection points, Public awareness about contamination of land and water by waste oil and other hazardous chemicals	Environmental education through campaigns, provision of infrastructure for disposal of waste oil.	Capacity to provide awareness on hazardous chemicals including mercury.
Kalahari Conservation Society	Capacity building for NGO's and CBO's and research	Environmental campaigns, awareness and education	Has capacity to organise training workshops on environmental issues, and research.
Mmegi Publishing Trust	Media coverage, broadcasting, publications and educational campaigns.	Can be used to cover a number of media houses for information dissemination on mercury	Have capacity to cover any topic and disseminate it electronically across the country and media houses

5.10.8 Academic Institutions

University colleges, Schools, institutes of Health Sciences and tertiary institutions provide an opportunity and forum for several people to be reached and instil knowledge to many generations. The mercury issues related to health and the environment can be included formally and informally in school programmes to raise awareness among both teachers/lecturers, students, laboratory technicians, and other staff and board members. The use of existing Enviro-Clubs in some schools will be crucial as it will encourage students to student learning.

5.10.9 Vulnerable Populations

There are regions or specific areas where concentration and contamination of mercury may occur, and these are areas where anthropogenic mercury occur including industrial activities and landfill site as well incinerating facilities. Specific exposure scenarios should situations where people may be exposed directly to mercury through dental amalgams and cultural religious practices.

There following are areas and places where people are likely to be exposed;

- Though Batswana are not large fish consumers compered to global averages, they may be exposed to methylmercury
- Fillings and traditional healers using mercury in their practices
- Industrial sites
- Waste disposal sites especially landfills and incinerators as waste is not separated at the source of generation
- Household exposure, the sale of mercury and mercury added products in Botswana is not regulated and many products are just bought over the counter in most clinics and pharmacies.
- Populations working around coal-burning production sites, coal burning boiler sites, smelters and cement producers may be vulnerable to mercury exposure.
- Staff and patients in medical health facilities may be exposed to mercury waste stored or incinerator sites.
- Patients having dental amalgams fillings may only be at risk if filling cracks causing the break-down of the compound
- ***Sekete***, where traditional healers use on patients as a belief that someone will be powerful and its purchased in pharmacies

Information on mercury should reach all social and economic sectors in Botswana. Stakeholders are not the same in terms of influence and the role they play in information dissemination, some are primary or key and more fundamentally linked to the success of Department of Waste Management and Pollution Control, while others are secondary.

Key stakeholders can be divided into primary stakeholders, or those who have a direct stake in information dissemination and awareness raising, and those who are very influential, especially in terms of reputation and brand awareness.

Table 29: Other Stakeholders and their key messages for awareness in Botswana

Target Group	Program	Key Message
Ministry of Finance and Economic Planning (Incorporation of MIA in NDP)	Presentations Documentaries	Requirements of the Minamata Convention and other MIA Environmental and health impacts Incorporation in the NDP
Government Department	Workshops Documentaries Seminars and Conferences Fairs Government Websites IEC materials	Environmental and health effects of mercury Incorporation Annual budgets and strategic Planning Guidelines on implementation awareness campaigns
Botswana Dental Association	Seminars and Fairs Workshops IEC materials Publications	Safe disposal of mercury waste and thermometers Guidelines to reduce exposure to patients Effects of mercury on patients
Environmental and Public Health Educators	Workshops and Seminars Social media Television and radio IEC materials Publications Documentaries	Environmental and health impacts Requirements of the Minamata Convention Guidelines of awareness raising Safe disposal of mercury waste Guidelines for minimising mercury exposure

Procurement Officers	Workshops and seminars	Planning on elimination of mercury Guidelines of minimising purchase Polluter Pay Principle
Academic and Researchers	Publications Newsletters Workshops Conferences Conference of Parties Proceedings (COP)	COP on MIA proceedings and attendance Further research on mercury handling and disposal to guide policy development
General Public	*Kgotla* meetings Public gatherings Television and Radio Newspapers Social media Billboards	Hazards and risk of handling mercury containing products Safe disposal of mercury waste
Entrepreneurs/Investors	Newspapers Radio and Television Social media	Business opportunities on handling mercury wastes Safe disposal of mercury containing products (fluorescent bulbs)
Students	Newsletters Documentaries Government websites Television and radio Social media	Environmental and health impacts of mercury Safe handling of mercury containing products Safe disposal of merry wastes
Educators	Newsletters	Environmental and health impacts of mercury

	Documentaries Government websites Television and radio Social media	Safe handling of mercury containing products Safe disposal of merry wastes Infusing mercury education on school curriculum
NGO's	Workshops Publications Newsletters	Minamata Convention Guidelines on awareness raising on mercury Environmental and health effects of mercury
Media	Workshops Press Release and Conference Websites Social media	Reporting on mercury Raising awareness on the dangers on safe management of mercury
Landfill Operators	Posters Billboards Workshops Radio and television	Safe handling and disposal of mercury waste Waste separation at source of generation
Incinerator Operators	Posters Billboards Workshops Radio and television	Safe handling and disposal of mercury waste Waste separation at source of generation
Botswana Chamber of Mines	Publications Newsletters Social media Billboards	Safe handling and disposal of mercury waste Waste separation at source of generation
Traditional Doctors	Workshops Posters	Effects of mercury of human health

		Safe handling and disposal of mercury containing products
Household	Television and Radio Billboards Social media	Effects of mercury of human health Safe handling and disposal of mercury containing products
Commuters (Railway, Road and Air)	Billboards Posters Social media	Environmental and health effects of handling mercury Safe disposal

5.11 Awareness raising tools applicable in the Minamata convention strategy

5.11.1 Print Media

Print media provides up to date information for public consumption in Botswana. Print media such as posters, flyers, newspapers and billboards can be used as part of the IEC materials for dissemination of information on Minamata Convention and MIAs. Posters and flyers can be targeted at among other, schools (including tertiary institutions government departments and factories. Billboards have a potential of having a significant impact when it comes to awareness as they are placed in visible areas where people see them every day. Messages communicated through posters and billboards must be clear, succinct and designed attractively to catch attention of target groups.

5.11.2 Television and Radio Programmes

In Botswana about 86.2% of the population have access to radio and 85.2% of the population have access to television and multiple newspapers, as such Batswana are a relatively informed nation. A forum can be established as a medium for raising awareness around the negative human health and environmental impacts of mercury and mercury containing products.

An opportunity exists in the television and radio broadcast as the Ministry of Education, Ministry of Agriculture and Food Security already have slots on the public broadcasters such as Botswana Television (BTV) and Radio Botswana. NOW TV which mostly broadcasts youth related content can be used to as a forum to disseminate information targeted for the youth viewers. These slots should be scheduled to times when most people are able to watch TV or listen to radio. For instance, TV programmes can be scheduled for evening hours when most people have knocked off from work. An alternative drama on TV is one of the programmes which can catch a large audience at it can be educational and entertaining as well.

5.11.3 Botswana Educational Television (BeTV)

This has been launched by the Ministry Education Skills and Development as a channel dedicated to enable pupils and distance learners to access the programmes even at home without interfering with general television services.

5.11.4 ICT as a Learning Platform

ICT infrastructure Development which includes integration of ICT in teaching and learning as well as Video streaming of lessons has been introduced to some schools in Botswana, in both secondary and primary schools. This can also be used to disseminate information on mercury to students especially in rural and remote areas.

5.11.5 Social Media

As at March 2016 mobile phone access stood at 3.5 million subscribers, meaning that there were 3.5 million active mobile sim-cards use in Botswana. There were also 1.4 Million phone internet users in Botswana. BOCRA (Botswana Telecommunication Authority), A number of institutions like commercial Banks, Medical aid providers and health practitioners as well as government (Department of Road, Transport and Safety), use this services to remind their clients on renewal of licences, when due for check-up and bank statements. This can be one forum used to disseminate short messages on mercury hazards as it has a wider coverage of the population.

Advancement in technology have made information dissemination to numerous people easy through use of social media such as Facebook, twitter and Instagram and instant messaging such as WhatsApp should therefore be used to reach youth and middle-aged groups of the population as they are the ones who are more knowledgeable on the issue of technology.

5.11.6 Formal Education

Inclusion of relevant information on Mercury in school's curriculum from as early as primary schools. This will initially require collaboration between the Ministry of Education and Tertiary Institutions and the Department of Waste Management and Pollution Control. Development of content to be included in the curriculum should take into consideration the level of understanding of targeted groups.

5.11.7 Community Outreach

There are several ways of disseminating information to the public including formal and informal systems. This encompass workshops, seminars, both broadcast and print media and traditional gatherings. Public awareness is mainly done through informal setting. For wider outreach, awareness materials like brochures, posters, pamphlets, newsletters, articles in newspapers, television and radio may be employed. The government broadcast (radio and television) and print media (daily news) run some programmes for free and easily accessible for information dissemination. The government also has a website where Ministries post information relating to the functions and programmes. These should be taken advantage of to disseminate information on mercury.

5.11.8 Public Places and Transport

Branding of public places such as Kiosk (*dimausu*), Bus stops, Buses, Taxis and combis with packaged information on Mercury can also be effective in dissemination of information on Mercury to the wider community of daily commuters, retailers, customers and the general public. In the past 2019 General Elections in Botswana this was the most used mode of selling the party and its candidates to the people.

5.11.9 Seminars and workshops

Seminars and workshops can serve as platforms to educate groups or individuals with common ground. For instance, they can be aimed at laboratory technicians, traditional healers and initiation schools. Health and environmental impacts of Mercury as well as potential alternatives to Mercury can be discussed in such platforms.

5.11.10 Spokespersons/Influencers

Children can be reached through spokespersons, namely teachers, parents, medical personnel, celebrities and environmental forums. The spokespersons can also use games/quizzes about nature protection, cartoons, children media and books about heroes that love and protect environment in order to help to raise public awareness.

Table 30: Awareness raising tools usable in the implementation of the Minamata Convention in Botswana

Awareness Raising Tools	IEC Material	Target Platform for Dissemination	Content to be Disseminated
Graphics	Brochures, Flyers, Posters, Display Boards, Banners, Stickers, Fact Sheets	1. Community Centres 2. Municipal/ Village/ Town Council Offices 3. Shopping Malls/Centres 4. Health Centres/Hospitals 5. Schools/universities	1. Mercury added products 2. Sources and Environmental and health effects of mercury exposure 3. Announcements on mercury outreach/community awareness programmes 4. Announcements on Community monitoring activities 5. Use of mercury containing products in healthcare equipment and treatments
Audio-Visuals	Videotapes, Slides, Flip Charts.	Schools, Community Centres, Workshops/Short Training Programmes	1. Monitoring and remediation of mercury releases 2. Sources and environmental and health effects of mercury exposure
Print Media	Newspapers, Magazines, Pocket Handbooks, Sustainable Development Scorecards	1. Homes 2. Workplace 3. Community Centres 4. Municipal/ Village/ Town Council Offices 5. Shopping Malls/Centres, 6. Workshops/ Short Training Programmes	1. Laws/regulations for mercury products control 2. Advertisements to encourage shopping for mercury-free products including cosmetics 3. Technical Guidelines on Mercury Monitoring and Treatment
Mass Media & Spokespersons/ Role models	Radio, Television	1. Homes 2. Workplace 3. Health Centres/Hospitals	1. Advertisements to encourage shopping for mercury-free products including cosmetics 2. The main use of the mercury, such as: seeds, cultural practices, ink, leather, naval shipyards, batteries,

			photographic cameras and industrial parks, including the use in dental amalgam. 3. Exposure to mercury-related occupational health and safety hazards 4. Use of mercury containing products in healthcare equipment and treatments
Online Media	Websites/Webpages, Social Media	1. Homes 2. Workplace 3. Community Centres 4. Health Centres/Hospitals	1. Laws/regulations for mercury products control 2. Announcements on mercury related outreach/community awareness programmes 3. Announcements on Community Monitoring activities 4. Database of Mercury Handlers
Competitions	Technology outputs (innovative products), Quizzes	1. Workplace 2. Schools 3. Business Expo/Trade Fairs	1. Mercury-free and sustainable technologies and technical alternatives
Environmental Education	School Curriculum Give-aways (e.g. mercury information-branded stationery), Quizzes, Cartoons	1. Schools 2. TVET Centres 3. Workshops/ Short Training	1. Mercurial contamination in soil erosion, forests burn, and water 2. Biological degradation, alteration of original habitats, as well as the biota contamination 3. Clean and sustainable technologies and technical alternatives 4. Technical and safety aspects of mercury products and processes 5. Measurement of methylmercury in different media

5.12 Access and availability of information

The government has established several public libraries throughout the country especially in towns and major villages. These libraries are meant to promote public access to information. Schools especially secondary schools and tertiary levels also have libraries for students and teachers use within government institutions, resource centres have been established for ease of access to information relating to that sector.

In terms of availability, necessary information on Mercury and the Minamata Convention should be available and target groups should be made aware of available information and where it can be accessed. Notice boards, websites and newsletters can be used to notify target groups of where to access detailed information.

5.13 Record keeping and Archiving

It is important that there be proper record keeping of programmes for the purpose of future use and monitoring and evaluation as well as accountability. Records to be kept shall include, target and groups reached, number of attendances at meetings, workshops and public gatherings as well as minutes of meetings held.

5.14 Potential barriers

There may be potential barriers in the awareness campaigns and information dissemination that may have to be overcome. It is important to understand them so that appropriate strategies may be employed bearing in mind the sensitivities that each may require.

Table 31: Dissemination of Information, barriers and their mitigation in the implementation of the Minamata Convention

Article 18 of the Minamata convention	**Potential Barriers**	**Recommended solutions**
1.Each Party shall, within its capabilities, promote and facilitate: (a) Provision to the public of available information on various topics as outlined in the Convention. (b) Education, training and public awareness related to the effects of exposure to mercury and mercury compounds on human health and the environment in collaboration with relevant intergovernmental and non-governmental organizations and vulnerable populations, as appropriate.	• Low Literacy levels This may hinder part of the public from understanding some of the content outlined in the convention. • Cultural beliefs which hinder behavioural change There are existing cultural beliefs among population groups (women and other vulnerable groups) which may hinder behavioural change in relation to use of Mercury. • Poor collaboration between government departments and NGOs and vulnerable groups; • Limited financial resources Resources can limit both in government in developing the IEC materials as well as the target user in terms of obtaining them if there is an associated cost. • Lack of interest in reading	• Use of local language as much as possible in particular in rural areas; Use of visual aids to ensure better and quicker understanding • Continuous awareness raising on the risks of Mercury exposure; • Identification and awareness raising on alternatives for Mercury and Mercury added products; • Strengthen collaboration between government and NGOs and vulnerable groups. • Sufficient budget should be allocated for information dissemination activities. mainstreaming; • IEC materials should be availed for free at information centres. • Use of billboards as they capture attention; • MBE should encourage culture or of reading in students from a young age. • The government should work towards developing mechanisms such as pollutant release transfer register. In addition, an initiative to establish Botswana Chemical Information

		Exchange Network (CIEN) should be pursued to completion. • Polluters should also be capacitated in providing relevant information for PRTRs. • Development of PRTRs and Botswana CIEN should be incorporated into government budget.
2. Each Party shall use existing mechanisms or give consideration to the development of mechanisms, Such as pollutants release and transfer registers (PRTRs)where applicable, for the collection and dissemination of information on estimates of its annual quantities of mercury and mercury compounds that are emitted. Released of disposed of through human activities.	• There are no existing mechanisms in relation to sharing of information on pollution. • The process of developing mechanisms such as PRTRs is for sharing information on pollutant release may be costly.	

Chapter 6: Challenges, Gaps and Priorities for Action

6.1 Regulatory and Institutional Gaps

There are significant gaps in the regulatory regimes of hazardous substances and wastes in Botswana. Regarding hazardous substances, these include the absence of local and comprehensive rules that address accident prevention, preparedness and response. What is available is non-binding international classification, labelling and packaging system (GHS) that is not even codified into local law. This lack of domestic law on many aspects of chemicals management presents problems for Botswana given the increasing availability of chemicals in many spheres of live in the country.

The Road Traffic Act makes provision on the specification for licensing of drivers of vehicles conveying hazardous goods, and there is no specific reference to the relevant MEAs. This Act defines "hazardous goods" as dangerous goods or substances which shall include but not limited to packages, unit load, bulk transportation equipment, petroleum-based flammable liquids and other objects that are considered hazardous or dangerous in terms of this Act. This Act has limitations in the management of chemicals with more reliance being put on the Waste Management Act. Many chemicals that are being transported are not waste and therefore outside the scope of the Waste Management Act in the strictest sense. These are chemicals that are still in the market and are being transported across the country for commercial reasons. Given these circumstances it is clear that Botswana needs a comprehensive chemicals management legislation that will deal with chemicals in the market while the Waste Management Act will deal with them when they become waste.

The Environmental Impact Assessment Act is also weak on the institutional linkages with other key legislations. It creates a separate mechanism for management of chemicals and chemicals waste, in a generalized manner that is not specific to the requirements of the MEAs. It has no regulations and is not capable of effective implementation as certain Orders required to be published by the Minister are not yet published. The ack of subordinate legislation (regulations, orders, etc) limits the applicability of this Act as well.

The proliferation of instruments and the fragmentation in the regulatory regimes create the need for institutional coordination and cooperation, as well as the implementation of the various legal instruments in a mutually supportive manner. At local level, important steps must be taken to enhance coordination, cooperation and synergy among the Basel, Rotterdam, Stockholm and Minamata conventions.

6.2 Mercury Emissions and Sources: Coal Fired Plants

One of the most challenging issues regarding mercury management in Botswana is to control atmospheric emissions of mercury from coal-burning power generation plants. Coal-fired power generations accounts for almost the total energy generation capacity in Botswana. A study carried out by World Bank Group with MMEWR in 2016 indicated that the coal-fired electricity production in Botswana led to an almost five-fold increase in domestic carbon dioxide (CO_2) emissions, from 0.7 million tons during 2010/11 to 3.2 million tons during 2014/15. The latter is around 1.5 t/person and represents a significant environmental cost. Botswana has not yet made efforts to transit from coal-fired energy to renewable energy generation though there is a huge potential from solar power. The Minamata convention does not oblige the parties (under Article 8) to necessarily establish mercury monitoring networks. It requires development of NAP in this

regard and also the application of Best Available Technologies (BAT) and Best Environmental Practices (BEP).

To support implementation of BET/BAT, the existence of a well-planned monitoring network in Botswana is necessary that sets up mercury emission limit values, identifies the non-complaint industries/emitter's, maps the populations at risk of mercury exposure, and ultimately supports the development of an inventory of mercury emissions from relevant sources. The availability of a mercury emission inventory will ultimately contribute to developing Botswana's NAP setting out the measures to be taken to control mercury emissions/releases and its expected targets, goals, and outcomes. The mercury monitoring networks will also help in knowledge-based implementation of already existing environmental management regulations in Botswana.

6.3 Mercury in the Health Sector

The effective protection of human through the implementation of the Minamata convention requires adequate capacities in the health sector at national level. To meet the objectives of the Minamata convention and fulfill the responsibilities of the health sector as a user of mercury containing products, adequate capabilities should be established in the ministries and institutions relevant to the implementation of the convention. In low-and middle-income countries implementation of the Minamata convention may prove more challenging owing to limited in-country resources and capacities.

For example, the phasing-out of mercury containing thermometers and sphygmomanometers in the healthcare requires the implementation of several activities. These activities involve availability of human and technical resources, including but not limited to conducting an inventory to identify the number and uses of mercury-containing devices. In addition, it requires evaluating alternatives, safe removal and disposal of mercury-containing devices, educating health care personnel and those who are involved in waste management, and maintaining and calibrating the alternative equipment as well as monitoring to ensure its effectiveness.

Phasing down the use of dental amalgam, especially in developing countries where it is still in use, requires the wide set of activities. It should start with the promotion of alternatives to dental amalgam in dental restoration when clinically indicated. It is necessary to build capacity among dentists of oral health promotion and disease prevention. The creation of awareness of the potential impacts on the environment of dental amalgam waste, support of best management practices and environmentally sound management of waste. In addition, introduction of health care waste separation and the use of special facilities for hazardous waste storage and treatment. For all these activities the presence of regulatory frameworks and legislation is needed.

Also, the implementation of the Minamata convention demands paying attention to mercury-containing bio-medical waste that contains traces of mercury. The appropriate handling of bio-medical waste must be done by qualified personnel. The staff in the dental clinics must be trained so that they may properly segregate and collect mercury contaminated waste that arises from their operations.

The Code of Practice of Clinical Waste Management has been developed and is being implemented as part of the Waste Management Act. The Code of Practice has categorized clinical waste into six (6) different groups for management and disposal purposes, namely 1) biological wastes, 2) infectious Wastes, 3) sharps 4) body fluids/excreta 5) radioactive 6) chemical wastes. Clinical wastes 1, 2 and 3 have been identified for disposal by incineration. The incineration such as the type, basic design and operational criteria have also been addressed. The Code of Practice however does specify the emission standards for the incinerators. The Waste Management Act is also silent about registration and licensing of incinerators.

Since much of clinical waste is treated by means of incineration, the Atmospheric Pollution Prevention Act, 1971, is relevant. The Act has the power to require registration of industrial processes within controlled areas, which are capable of emitting objectable matter. Registration is subject to satisfying the Air Pollution Control Officer that the Best Practicable Means of preventing or reducing such emissions is employed. However, there is no provision for application of any specific emission criteria. It is also questionable whether waste incinerators in landfills and health facilities can be regulated or controlled by this Act. The Act makes no provision for emission standards for incinerators.

6.4 Electronic Waste - (E-Waste)

E-waste management has become a major challenge due to limited capacity, lack of investment, and lack of comprehensive systems that are monitoring its generation or its movement or a coordinated strategic framework of action to deal with it in a sustainable manner. For better management of -waste, countries must establish rules and regulations that control what must happen to electrical and electronic equipment's when they reach their end of life.

With the rapid development of electronic technology and global improvements of living standards, the lifespan of electrical and electronic equipment has greatly reduced, resulting in increasing quantities and types of E-waste. E-waste is a complex waste category because of the combination of heterogeneous materials it contains, both hazardous substances (e.g. lead, polychlorinated biphenyls (PCBs), mercury, polybrominated diphenyl ethers (PBDEs), and other coolants with heavy metal potential of environmental impact.

In Botswana, there is no specific legislation that deals specifically with E-waste, although the Waste Management Act was passed in 1998 after the ratification of the Basel convention to deal with issues such as hazardous waste. Due to unavailability of ''E-waste policy'' it is difficult to identify stakeholders in the E-waste management system and hierarchy. There is no data on the amount of E-waste produced in Botswana and the quantities exported to South Africa for recycling and disposal. The bulk of E-waste ends on metal scrap dealers who extract valuable components and the rest in ungazetted disposal sites and landfills across the country.

6.5 Mercury monitoring in the country

The availability of detailed and systematic inventories of mercury supply, trade, and consumption would be important for establishing mercury management programs, in developing countries. The Minamata convention requires Parties to prepare an inventory on mercury trade, supply and consumption. In Botswana such inventory will be effective in controlling and managing illegal marketing and use of mercury, its unidentified stockpiles, risk of its accidental releases. This inventory must focus on mercury (and its compounds) stockpiles, emissions and releases in different sectors and matrices.

Evaluating the effectiveness of the Minamata Convention (as required by Article 22) in terms of curbing mercury pollution is an important component to ensure that the convention meets the objective of protection of human health and the environment from mercury pollution. There are several complexities in assessing the changes in mercury concentrations in the environment and in humans in Botswana. DWMPC working together with tertiary institutions in the country must develop monitoring protocols and researchers must take interest in various aspects of this problem so that the country may develop its own baseline and patterns of pollution that it faces.

6.6 Waste Treatment and Disposal Capacity

Currently there are fourteen (14) landfills in the country, but none of them accept nor treat hazardous waste. The bulk of hazardous waste is exported to South Africa for treatment and disposal. There are no treatment facilities for hazardous waste though most landfills have incinerators. Most of these incinerators do not have the necessary abatement technology to control emissions from the incineration process. Mercury however as it is found in equipment and products is obtainable in these landfills since it forms part of the mixed waste.

6.7 Environmental Monitoring

As part of the MIA process, Botswana has conducted inventories to determine the sources of mercury, however there is also a need to study the level of exposure of mercury on the environment and humans. As such there is need for capacity building both in terms of infrastructure, technology, financial and human resources to meet the obligations of the Minamata Convection. Botswana has several government laboratories that need to be upgraded and sufficiently capacitated to meet the country's needs for continuous monitoring.

6.8 Institutional and administrative

Botswana has passed several specific laws and stablished administrative arrangements that cover some aspects of the Basel, Rotterdam, Stockholm and Minamata Conventions. The government departments and administrative frameworks play an important role in the implementation of the Minamata Convention.

Botswana does not yet have a comprehensive chemicals framework law. The chemicals are addressed in fragmented pieces of legislation that are implemented by various government departments and ministries. While acknowledging a unique role that may still need to be played by some entities in the chemicals' management arena, a comprehensive chemicals framework law would go a long way towards providing a coordinated chemicals management in the country.

Table 32: Ministries and their Role in Chemicals Management in Botswana

Ministry		Role
Trade and Industry	☛	The Ministry is competent in matters pertaining to the manufacture of chemicals and chemicals products; the Ministry: • *Assesses and issues manufacturing licenses to prospective traders* • *Is a custodian of the Trade Act and Industrial Act which stipulates the training that people who trade with chemicals must have* • *Houses BOBS, which is a standard body, mandated to formulate national standards* • *Develops the Safety Data Sheet for Chemical Products-BOS ISO 11014-1:1994 and Classification, labelling and Packaging of Chemicals*
Employment, Labor and Productivity	☛	• *Is responsible for ensuring that the provision of the ILO convention N.170 concerning safety in the use of chemicals at work is implemented.* • *Administers the Factories Act that holds employers accountable for the health and safety of their employees.* • *The Act provides that employees, who work in certain hazardous conditions, work with proper PPE*
Finance and Development		Through BURS, ensures that chemicals do not enter the country contrary to the Ministry and applicable regulations, tariffs and duties.
Local Government	☛ ☛	• *Through the local authorities regulates the sale of chemicals by screening applications and issuing trading licenses to prospective traders.* • *Plays implementing role and enforces the various pieces of legislation that have been formulated by other ministries.*

Transport and Communication		Competent in matters related to the transportation of chemicals and storage during the distribution phase

Table 33: Legislative Instruments, Scope, Gaps and Challenges

Legal Instrument	Scope	Relevance to MEAs	Responsible Institution
Agro-Chemicals Act	Provides for the registration and licensing of agrochemicals, their importation, manufacture, distribution, use and disposal	It addresses some aspects of chemicals lifecycle management; the Act has limited relevance to key MEAs. By design the Act is meant to address agrochemicals. The broad aspects of the MEAs such as the MFN principle, domestic production, export, and listing/notification are not addressed. The Act hardly deals with key aspects of the MEAs in particular the Rotterdam Convention.	Department of Plant Protection (MAFS)
Atmospheric Pollution Prevention Act	Provides for the prevention of pollution of the atmosphere by carrying out of industrial processes	Although the Act deals with pollution aspects of industrial chemicals, it is of very limited relevance to the MEAs.	DWMPC (MENRCT)
Factories Act	Makes provision for the regulations of the conditions of employment in factories as regards the safety, health, and welfare of employees	Has no relevance to industrial chemicals, limited to workplace safety and doesn't address key issues of MEAs	MLPE
Public Health Act	Concerned in part Environmental health Protection under part x1, Section 95-103	Designed to address harm to the environment from any source of pollution. In these aspects, is relevant to MEAs. It is relevant to the Rotterdam and Basel Conventions	The Act is under the MOHW, which also administers the Drugs and Related Substances.
Waste Management Act	The Act provides for the planning, facilitation and implementation of advanced systems for regulating the management of controlled waste	The act directly domesticates one of the key industrial chemical instruments, the Basel Convention. The Convention is fully integrated into legislation as regulations attached to the main body of the law. the Act has partly aspects dealt with the waste aspect of chemicals management.	DWMPC (MENCT)

Table 34: Relevance and Applicability of the Minamata Convention Articles to Botswana

Article and Components	Relevance to Botswana	Gap	Opportunity
Article 3: Mercury supply sources and trade			
Not allow the import of mercury of mercury without government consent, ensuring both the mercury source and proposed use are allowed under the Convention	**Yes**	There is no ongoing monitoring of mercury in the country.	Mercury is already imported into Botswana in small quantities and monitoring by a small number of institutions. These can easily be traced and put under control.
Article 4: Mercury Added Products			
Not allow the manufacture, import, and export of products listed in Part 1 of Annex A, following the phase out date in Annex A	Yes	There are no restrictions on importing mercury added products (Annex A) and dental amalgam (Annex B)	Botswana does not manufacture or export products listed in Part 1 of Annex A. The focus must just be on imports.
Phase down the use of dental amalgam through two or more measures listed in Part 1 of Annex A	Yes	There is still continued use more awareness is needed.	Botswana is already phasing down the use of amalgam in dental clinics but the process is slow. Given the fact the process has started upscaling is possible. The alternatives are available.
Prevent the incorporation of products listed in Part 1 of Annex A (i.e., switches and relays, batteries) into larger assembler products	Yes	No guidelines in place to prevent the incorporation of the products listed in Part 1 of Annex A	Botswana does not manufacture products listed in Part 1 of Annex A. Importation can be controlled.
Discourage the manufacture and distribution of mercury added products not covered by any known use before the Convention comes into force	**Yes**	Currently there are no restrictions on the manufacture and distribution of mercury added products not covered by the Convention in Botswana.	There is no manufacturing of MAPs locally importation can be controlled.
Article 5: Manufacturing processes in which mercury and mercury compounds are used			

Not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part 1 of Annex B, following the Annex B phase out date.	**No**		No manufacturing of Part 1 Annex B products in which mercury or mercury added products takes place in Botswana.
Restrict (as specified in the Annex) the use of mercury in the processes listed in Part 1 of Annex B.	**No**		None of the processes listed in Part 1 of Annex B take place in Botswana
Not allow new facilities to use mercury in the regulated processes under Article 5, as specified in Annex B.	**No**		None of the processes listed in Part 1 of Annex B take place in Botswana
For facilities with processes listed in Annex B, identify and obtain information on mercury or mercury compounds use, and control mercury emissions to air and releases to land and water	**No**		None of the processes listed in Part 1 of Annex B take place in Botswana
Discourage uses of mercury in industrial processes (guidelines to be covered by COP)	**No**		None of the processes listed in Part 1 of Annex B take place in Botswana
Article 7: Artisanal and small-scale gold mining			
Reduce, and where feasible, eliminate mercury and mercury compounds use, emissions (to air), and releases (to land and water) associated with ASGM	**Some what**	There is anecdotal information indicating that ASGM is taking place at a very small scale in Botswana. The challenge is the ASGM taking place illegally in South Africa since participants remain outside government focus in both countries.	Only a small population is involved in this which presents an opportunity of providing targeted intervention to them.
Establish a coordinating mechanism and delineate agency roles for devilment/implementation of an ASGM National Action Plan (NAP)	**Some what**	Currently there is no NAP for ASGM in Botswana.	Only a small population is involved in this which presents an opportunity of providing targeted intervention to them.

Define, formalize and regulate ASGM consistent with the Convention.	**Some what**	No regulations for ASGM currently exist in Botswana, and this industry is not well understood in the country.	Only a small population is involved in this which presents an opportunity of providing targeted intervention to them.
Eliminate whole ore amalgamation, open burning of amalgam or processed amalgam, burning of amalgam in residential areas, and cyanide leaching of mercury-laden sediment, ore or tailings	**No**		None of the outlined measures have been restricted in Botswana however, there is no indication that any of these activities are currently taking place.
Set mercury use reduction goals or targets consistent with the timely elimination of the worst practices associated with ASGM and other use reduction efforts.	**No**	No reduction goals or targets currently exist in Botswana, though it is not clear if ASGM activities are taking place in the country.	None of the outlined measures have been restricted in Botswana however, it is believed that this activity takes place outside the country not within the country.
Reduce mercury emissions, releases, and exposure associated with ASGM, and prevent mercury exposure of vulnerable populations (particularly women of child-bearing age and children	**No**		There are no reports or records of vulnerable populations affected by ASGM in Botswana. It is believed that this activity takes place outside the country.
Prevent the diversion of mercury and mercury compounds from other sectors to ASGM, and manage mercury trade constant with NAP	**No**		Since there is no active ASGM in the country no further measures are necessary.
Implement a public health strategy to address mercury exposure to ASGM miners and communities.	**Some what**	No public health strategies to address mercury exposure have been implemented	There re miners exposed to mercury from the ASGM in South Africa. The numbers are small providing an opportunity for targeted interventions.
Article 8: Emissions			
Require best available techniques / best environmental practices (BAT/BET) or associated emission values (ELVs)for	**Yes**	No ELVs exist in (Botswana) though BAT/BEP are recommended as part of the EIA process.	The vast majority of people are yet to get access to electricity which means more plants are yet to be built. Currently Botswana only produces 202 MW. The

new facilities (as defined in Article 8.2 (c.			new facilities present an opportunity to meet the BAT/BEP requirements as recommended including setting ambitious ELVs.
Require one or more measures identified in Article 8.5 to control/reduce mercury emissions from existing sources listed in Annex D, which shall be operational at the source within 10 years.	**Yes**	Currently no measures to control and reduce existing mercury emission in place for those activities listed in Annex D	There are few power plants which presents an opportunity to implement these new measures.
Require monitoring/reporting and /or otherwise establish a mercury emissions inventory for sources listed in Annex D.	**Yes**	No monitoring/records of mercury emissions are kept for sources identified in Annex D	There are few power plants which presents an opportunity to implement these new measures.
Article 9: Releases			
Require reporting /or otherwise obtain information as needed to identify significant sources of mercury/mercury compound releases to land or water, and to maintain an inventory of releases from the sources identified.	**Some what**	There is no definitive understanding of the significant sources of mercury releases in Botswana. In addition, no inventory or reporting of releases from sources is currently implemented in Botswana. However, it is not believed that there are many major release sources currently in Botswana.	It is believed that there are only few such sources in the country which presents an opportunity to provide targeted interventions.
Require one or more measures specified in Article 9.5 to control/reduce mercury and mercury compounds releases to land and water, and to maintain an inventory of releases from the sources the country identifies.	**Some what**	No mercury release limit values, techniques, practices, multi-pollutant control strategies or alternative measures to control and reduce releases from relevant sources are being implemented in Botswana however, it is not believed that there are any major release sources currently in Botswana	It is believed that there are only few such sources in the country which presents an opportunity to provide targeted interventions.
Article 10: Environmentally sound interim storage of mercury, other than waste mercury			

Ensure interim mercury storage is conducted in an environmentally sound manner, considering guidelines to be developed by the Conference of Parties	**Some what**	No strategies, safety guidelines or legislation exists to ensure interim mercury storage specifically.	There is no evidence of large quantities of mercury in interim storage. Mercury that is stored, is expected to be in the form of MAPs that are treated as waste.
Article 11: Mercury Wastes			
Use a definition of mercury waste consistent with Article 11.2	**Yes**	There is no legal definition of mercury waste in Botswana.	A development of a chemicals framework law could provide an opportunity to address this issue. The Waste Management Act could also me amended to include a definition consistent with Article 11.2.
Manage mercury wastes in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirement to be developed.	**Yes**	Mercury waste is not separated and managed apart from the rest of the waste.	The Basel Convention currently adhered to and implemented by DWMPC
Restrict mercury derived from the treatment or re-use of mercury waste to allow uses under the Convention or environmentally sound disposal	**No**		No mercury is collected for re-use from the treatment facilities in the country.
Require transport across international boundaries in accordance with the Basel Convention does apply, consistent with international rules, standards, and guidelines	**Yes**	No gap identified in this respect	Basel Convention currently adhered to in Botswana and implemented by DWMPC
Article 12: Contaminated sites			
Develop strategies for identifying and assessing mercury/mercury compound contaminated sited	**No**		No mercury contaminated sites found in Botswana

If risk reduction activities are taken at contaminated sites, they are taken in an environmentally sound manner, incorporating risk assessment where appropriate.	**No**		No mercury contaminated sites found in Botswana
Article 16: Health Aspects			
Promotes the development and implementation of strategies to identity and protect populations at risk, such as developing fish consumption guidelines	**Yes**	No strategies in place for the development and implementation to identify and protect populations at risk. Some guidelines exist but need to be strengthened	No known widespread exposure to the population including indigenous populations. Because the problem is not at crisis level opportunities to implement new measures are possible.
Promote occupational exposure and preventative programs	**Yes**	No occupational exposure education and prevention programs are currently in Botswana in regard to mercury	Since the country is now a Party to the Minamata convention it can leverage on this to develop new occupational guidelines and procedures.
Promote prevention, treatment and care services for affected populations	**Yes**	No prevention, treatment or care services to mercury affected populations exists in Botswana	Since the scale of the problem is assumed to be not so large this presents a possibility to implement these measures manageably.
Strengthen institutional and professional capacities for addressing health risks associated with mercury exposure	**Yes**	Currently no strengthening of institutional or professional capacities to address the health risks associated with mercury are undertaken in Botswana. This training would be particularly appropriate for health care professionals in the country.	This completion of the MIA presents information about the country that could be used in this regard.

Chapter 7: National Implementation Plan

For implementation of the Minamata Convention, the government of Botswana needs a coherent implementation plan with a clear set of priorities. This plan will assist Botswana to implement actions that will the exposure of the population and the environment to releases and emissions of mercury. This will save lives and assist Botswana to meet its international obligations in respect of the Minamata Convention.

7.1 Key Priority Areas

Based on the analysis and operational Articles of the Minamata Convention and the applicability to Botswana, the following are the priority areas which will eventually inform the Implementation Plan for the country.

The priority guiding principles will be the following

- To identify sources and quantities of mercury
- To domesticate the Minamata Convention on mercury in Botswana
- To restrict the importation of mercury and mercury added products.
- To facilitate the phasedown of dental amalgams
- To pave way for the development of the NAP for AGSM
- To implement emission control measures
- To control and manage mercury waste
- To improve healthcare aspects associated to mercury
- To raise awareness among the population including among the vulnerable groups

Priority 1. Further work on details of the mercury sources in Botswana

Although Botswana has undertaken the MIA which details the sources of mercury in the country, it is still clear that more in this area needs to be done. The MIA has only succeeded to point the country in the right direction in terms of the sources and the releases and emissions of mercury to air, land and water but many of these lack detailed scientific work. Through the guidance and leadership of the DWMPC and the universities in the country, Botswana must undertake more studies in order to understand the extent of the problem in the country.

Rationale: There are uncertainties regarding the sources of mercury in Botswana, no data has been collected to confirm the sources and quantities. Development of an inventory is required to define priority intervention areas for improved mercury management			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)

Detailed source specific work needs to be undertaken to profile mercury sources in the country	DWMPC	2021 – 2025	500, 000
More intensive work to investigate potential mercury hotspots some of which if existent could be contaminated sites.	DWMPC MOHW DOM	2021 – 2022	100, 00
Policy formulation to address mercury sources in the country.	DWMPC	2020 – 2022	150, 000
Total			750, 000

Priority2: Domestication of the Minamata Convention on mercury

Rationale: For effective implementation the Minamata convention will need to be domesticated into local law. Furthermore the domestication process will establish a legal and administrative framework for implementation.			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Mainstreaming of budgetary support for MEAs coordination in the country	DWMPC	2021 – 2025	100, 000
Amend respective sector legislation and regulatory frameworks to address the Minamata Convention. Primarily the budget is for stakeholder consultations where such consultations are deemed necessary.	DWPMC MLWSS MMRGTES MITI MHW MADFS	2021 – 2025	200, 000
Total			300, 000

Priority 3: Restrict the Importation of Mercury and Mercury added Products into the country

Rationale: There are no restrictions on the importation of mercury and mercury added products and there are no known natural sources of mercury in Botswana.			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Develop an inventory and quantities of mercury and MAPs in Botswana	DWMPC	2021 – 2023	300, 000
Develop data collection methods for monitoring cross border mercury imports	BURS MITI	2021 – 2022	100, 000

Develop technical guidelines for tracking MAPs in the country	BURS MITI	2021 - 2021	50, 000
Adopt measures to prevent the incorporation of MAPs into assembled products, the manufacture, import and export of which are restricted	DIA BOBS	2021 – 2022	50, 000
Discourage the manufacture and distribution in commerce of MAPs unknown prior to entry of the Convention unless a proper cost benefit analysis has been carried out.	DIA BOBS	2021 – 2022	20, 000
Conduct training on mercury management for staff in trade, port health officers, clearance and department of custom control	BURS MITI DWMPC DOH	2021 – 2021	150, 000
Total			670, 000

Priority 4: Measures to Phase Down Dental the use of Dental Amalgam

Rationale: Dental Amalgam continues to be imported mainly in capsular and used in dental procedures, signatories are encouraged to reduce dental amalgam use, reduce the exposure of patients and dental care professionals to mercury during dental treatment, and to avoid release of dental amalgams from clinics.			
Proposed Activity	Lead Institution	Time frame	Proposed Budget (BWP)
Support BODEA effort to Phase down and phaseout use of dental amalgam	BODEA MOH	2021 – 2025	50, 000
Undertake awareness raising of the environmental and health risks of mercury at dental clinics	BODEA MOHW DOHS	2021 – 2023	100, 000
• Phase-in these measures outlined in Annex A Part II • Setting national objectives aiming at dental caries preventing and health promotion, thereby minimizing need for dental restoration • Setting national objectives aiming at minimizing its use • Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration • Promoting research and development of quality mercury-free materials from dental restoration • Providing a curriculum and training for dental professionals, dental students on the use of mercury-free dental restoration alternatives and promoting best management practices. • Discouraging insurance policies and programs that favor use over mercury-free dental restoration. • Restricting the use of dental amalgam to its encapsulated from • Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land	BODEA HOHW DEA DWMPC	2022 – 2025	100, 000
Total			250, 000

Priority 5: Develop National Action Plan for AGSM

Rationale: There is uncertainty regarding the occurrence and prevalence of artisanal and small-scale gold miming (ASGM) in Botswana. Therefore there is need to cease the practice of ASGM to protect populations involved			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Undertake more detailed work to understand the nature and content of the ASGM in the region and how it affects Botswana.	DWMPC DOM	2021 – 2023	200, 000
Develop new legislation on the reduction, elimination and restriction of ASGM activities that affect Botswana	DWMPC DOM	2021 – 2022	100, 000
Collaborate with South Africa, Botswana mines and DOM to conduct regular monitoring and inspection around gold mines for the prevention of any ASGM activities	DOM	2021 – 2025	200, 000
Develop a proposal to source funds for the development of the NAP for Botswana.	DWMPC DOM	2021 – 2022	50, 000
Total			550, 000

Priority 6: Implement Emission Control Measures

Rationale: Botswana depends on coal-fired plans from electricity. However, there is no data on the amount of mercury released in emissions or the number of sources in Botswana. Therefore it is vital to reduce emissions from relevant sources by using the Best Available Technology and Best Environmental Practices (BAT/BEP)			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Identify sources of mercury emissions and determine potential quantities of mercury from each of the power plants and industrial boilers	DWMPC	2021 – 2023	200, 000
Monitor and maintain an inventory of emissions from all relevant sources in the country	DWMPC	2021 – 2025	250 000
Develop legislation to require BAT/BEP from new emission sources	DEA	2021 – 2022	100, 000
Implement one or more of the following measures on existing emission sources: • *A quantified reduction goal* • *Emission limit values* • *BAT/BEP*	DWMPC DEA DOHS	2021 - 2025	250, 000

• *A multi-pollutant control strategy that would deliver co-benefits for control of mercury emissions or* • *Alternative measures to reduce emission from relevant sources*			
Total			800, 000

Priority 7: Control Mercury Waste

Rationale: In Botswana, mercury waste is a result of MAPs that have been discarded in non-environmentally sound manner. It is apparent that few facilities have the financial means to ensure that mercury waste is managed according to the provision of the Basel Convention. Often mercury waste is mixed with other wastes and may be released on land and in water and a clear understanding of the relevant sources and quantities of mercury releases needs to be developed beyond the MIA.			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Do more work on the sources of mercury in Botswana to quantify their effect	DWMPC	2021 – 2024	300, 000
Establish national mercury waste thresholds that require mercury disposal action in line with Minamata convention.	DWMPC DEA	2021 – 2022	50, 000
Ensure that waste management collection staff at the local authority level are aware of the environmental and health risks associated with mercury (including MAPs) and can manage mercury waste in a safe manner and adhere to guidelines developed under the Basel Convention	DWMPC MLGRD DOHS	2021 – 2022	150, 000
Total			500, 000

Priority 8: Strengthen Health sector

Rationale: There is no specific policy in Botswana that addresses mercury exposure or its implications on human health. It is important therefore to protect populations at risk of mercury exposure by strategies and programs implemented to help protect populations at risk, especially vulnerable populations, which may include adoption of science-based health guidelines relating to mercury/mercury compounds exposure			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Implement recall and replacement of all mercury containing medical devices that continue to be found in medical facilities and dispose them off in an environmentally sound manner.	MOH DWMPC DOHS MLGRD	2021 – 2022	600 000
Conduct awareness raising to health sector staff of human health and environmental effects of mercury/mercury compounds and emphasize the Botswana Clinical Code of Practice regarding handling of disposal of mercury waste	MOH DWMPC DOHS MLGRD	2021 – 2021	100, 000
Total			700, 000

Priority 9: Public Information, Awareness and Education

Rationale: Public awareness regarding mercury as a hazardous substance, the potential health and environmental impacts of mercury are not widely known in Botswana. Few Batswana may be encountering mercury regularly through their workplace or regular household activities.			
Proposed Activity	Lead Institution	Time Frame	Proposed Budget (BWP)
Implement a general public awareness campaign regarding the human health and environmental impacts of mercury in Botswana	DWMPC MOH	2021 – 2022	300, 000
Develop sector specific and workplace awareness programs including border control, health facilities/laboratories	DWMPC MITI BURS DEA MOH BODEA DOM MLGRD	2021 – 2025	300, 000
Total			600, 000

Reference

Botswana Bureau of Standards, BOS 498: 2012. Ambient Air Quality.

Botswana Bureau of Standards, BOS 5666:1999., Water Quality, Determination of Mercury.

Botswana Communication and Regulatory Authority 2019, Annual Report

Botswana Power Cooperation; 2019 Annual Report

Botswana Government, 1998 Waste Management Act Chapter 65:06. Government Printer.

Botswana Government, Waste Management Strategy 1998. Government Printer

Government of Botswana, Botswana Printers.1971 Atmospheric Pollution Prevention Act 1971(CAP: 65:03), Gaborone, Botswana

Government of Botswana, 1999 Agro-Chemicals Act, Chapter 35:09

Government of Botswana 1966. Constitution of Botswana, 1966

Government of Botswana, Environmental Impact Assessment Act 2005

Government of Botswana, Factories Act, 1992; Cap 44:01

Government of Botswana, Public Health Act, Cap 63:01

Government of Botswana, Road Traffic Act, 1978: Chapter 46:05

Government Printers 2009. Children's Act 2009

Government Printers, 1992. Drugs and Related Substances, Chapter 63:04

Government Printers, 1970, Explosives Act, Chapter 24:02

Government of Botswana, 1967.Minerals and Mines Act Chapter 66:02, 1967

Government Printers Department of Environmental Affairs 2007 National Environmental Education Strategy and Action Plan, 2007-2012

Hatfield 2018 Minamata Convention Implementation Situational Analysis. Gaborone (2018)

Ministry of Environment and Sustainable Development 2014; Mauritius National Development Plan, (2015-2020). Port Luis: Mauritius

Ministry of Finance and Development Planning 2017 National Development Plan 11, Volume 1, April 2017.

Republic of Botswana. 1994 Revised National Policies on Education. Botswana. Series: Government Paper (1994) no. Government Printer

Sharma 2019. Journal Article: Implementation of the Minamata Convention to Manage Mercury Pollution in India: Challenges and Opportunities, Environmental Sciences Europe 31.

Statistics Botswana Communication Strategy 2013-2023

The United Nations in Botswana 2010. Millennium Development Goals, Status Report, Gaborone 2010.

United Nations Development Programme 2013 Minamata Convention on Mercury Geneva

World Health Organisation 2017: Implementation of the Minamata Convention in the Health Sector: Challenges and Opportunities