



# MINAMATA CONVENTION ON MERCURY INITIAL ASSESSMENT REPORT FOR GHANA

AUGUST 2018



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ON MERCURY INITIAL  
ASSESSMENT REPORT  
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# Foreword



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**M**ercury (symbol, Hg; atomic number, 80; and density, 13.56 gcm<sup>-3</sup>) is a naturally occurring element with wide range of uses and is released into the environment from a variety of sources. It exists in several forms as elemental or metallic mercury; inorganic mercury compounds; and organic mercury compounds.

Mercury is a very poisonous substance and has been recognized as a

chemical of global concern owing to its: (a) persistence in the environment once anthropogenically introduced; (b) ability to bioaccumulate in ecosystems; and (c) significant negative effects on human health and the environment, particularly in developing countries such as Ghana, which lack the appropriate capacities to deal with the dangers posed by the negative impacts of such chemicals. Ingestion and inhalation of mercury may produce significant adverse neurological and other health effects such as digestive and immune system dysfunction, diseases of the lungs, kidney, skin, eyes, etc. Harmful effects of mercury on vulnerable populations, particularly unborn children, children, and women of child-bearing age (especially pregnant women) are of particular concern.

Although mercury is a naturally occurring element, human activities (mainly industrial sources, including, the combustion of fossil fuels, mining, smelting, waste combustion) have increased the amount of mercury accumulated into the atmosphere and the natural environment as a whole. The biggest mercury releases come from coal-fired power stations and usage of mercury to separate gold ore-bearing rock, mainly Artisanal and small-scale mining (ASGM). Dental amalgamation, cement production and the production of iron are other anthropogenic activities that account for large sources of global emissions of mercury to air.

In Ghana the major source of emissions and releases of mercury into the natural environment is via human activities,

mainly through: (1) Primary metal production; (2) Gold extraction with mercury amalgamation from concentrates; and (3) Informal dumping of general waste.

In keeping with her tradition of supporting international efforts to address international environmental challenges, Ghana joined the rest of the world to negotiate the Minamata Convention on Mercury which was initiated in 2009 by the United Nations Environment Programme (UN Environment) Governing Council, and finally agreed after a series of intergovernmental negotiations meetings, by one hundred and forty-seven (147) Governments on January 19, 2013 in Geneva, Switzerland.

Ghana became a signatory to the Convention on 24th September 2014 and ratified it on 23rd March 2017. Ghana's ratification was achieved through collaboration with the United Nations Institute for Training and Research (UNITAR) and funding from the Government of Switzerland.

This Minamata Initial Assessment Report on mercury use, sources and releases in Ghana represents the collective efforts of several actors. It is a positive demonstration of the commitment of the Government of Ghana to fully implement its obligations as a Party to the Convention.

Consistent with the stated objective of the Convention in Article 1, which is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds, this assessment report comprehensively covers all actions required to be taken by Ghana to achieve the objective of the Convention.

The Convention prohibits the production and trade of a range of products containing mercury, including batteries, compact fluorescent lamps, switches and relays, soaps and cosmetics, thermometers, and blood pressure devices. Also prohibited are vaccines containing mercury, as well as dental fillings, which use mercury amalgam.

In accordance with Article 20, Ghana intends to use this initial assessment to develop and execute an implementation plan, taking into account the country's domestic circumstances, for meeting the obligations under Minamata Convention. This document is therefore presented to all Ghanaians and seek to solicit the support of all stakeholders in partnership with the international community, towards the achievement of the objective of the Convention, the sound management of chemicals and the 2030 Agenda for Sustainable Development.



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# Glossary

ACARP	Accra Compost and Recycling Plant
AFOLU	Agriculture, Forestry and other Land Use
AMCEN	African Ministerial Conference on Environment
ASGM	Artisanal Small-Scale Gold Mining
AU	African Union
BAT	Best Available Technologies
BEP	Best Environmental Practices
BNARI	Biotechnology and Nuclear Agriculture Research Institute
CCMC	Chemical Control and Management Centre
CEPS	Customs, Excise and Preventive Service
CFL	Compact Fluorescent Light
COP	Conference of Parties
CSIR	Centre for Scientific and Industrial Research
CSO	Civil Society Organizations
DNA	Designated National Authority
DVLA	Driver and Vehicle Licensing Authority
ECOWAS	Economic Community for West African States
EI	Executive Instrument
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
ER	Ecological Restorations
FAO	Food and Agriculture Organization
FDA	Food and Drugs Authority
FoN	Friends of the Nation
GAEC	Ghana Atomic Energy Commission
GCM	Ghana Chamber of Mines
GDP	Gross Domestic Product
GEDA	Ghana Electrical Dealers Association
GEF	Global Environment Facility
GGUMaT	George Grant University of Mines and Technology
GHACEM	Ghana Cement
GHG	Green House Gases
GHS	Ghana Health Service
GLSS	Ghana Living Standards Survey
GNASSM	Ghana National Association of Small Scale Miners
GNPC	Ghana National Petroleum Corporation
GRA	Ghana Revenue Authority
GSD	Geological Survey Department
GSGDA	Ghana Shared Growth Development Agenda
GSS	Ghana Statistical Service
GSSTI	Ghana Space Science and Technology Institute
GUTA	Ghana Union of Trade Associations
HCFC	Hydrochlorofluorocarbons
Hg	Mercury
HPMV	High Pressure Mercury Vapor



IAS	Invasive Alien Species
ILO	International Labour Organization
IRS	Internal Revenue Service
ISD	Information Services Department
ISSER	Institute for Statistical Social and Economic Research
KNNRI	Kwame Nkrumah Nuclear Research Institute
KVIP	Kumasi Ventilated Improved Pits
LED	Light Emitting Diodes
LI	Legislative Instrument
MC	Minerals Commission
MC	Minamata Convention
MDAs	Ministries, Departments and Agencies
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MeHg	Methylmercury
MELR	Ministry of Employment and Labour Relations
MESTI	Ministry of Environment, Science, Technology and Innovation
MIA	Minamata Initial Assessment
MJAGD	Ministry of Justice and Attorney General's Department
MLGRD	Ministry of Local Government and Rural Development
MMDAs	Metropolitan, Municipal and District Assemblies
MMIP	Multi-Sectoral Mining Integrated Project
MoF	Ministry of Finance
MOFAD	Ministry of Fisheries and Aquaculture Development
MOH	Ministry of Health
MoI	Ministry of Information
MoTI	Ministry of Trade and Industry
MT	Metric Tons
NAP	National Action Plan
NEP	National Environment Policy
NES	National Energy Statistics
NFP	National Focal Point
NGOs	Non-Governmental Organizations
NIP	National Implementation Plan
NLC	National Labour Commission
NNRI	National Nuclear Research Institute
NPI	Nuclear Power Institute
OHS	Occupational Health and Safety
OMC	Oil Marketing Companies
PIC	Prior Informed Consent
PM	Particulate Matter
PMA	Phenyl Mercuric Acetate
PMMC	Precious Minerals and Marketing Company
PNDCL	Provisional National Defense Council Law
POPs	Persistent Organic Pollutants
PUF	Polyurethane



R&D	Research and Development
RAMSRI	Radiological and Medical Sciences Research Institute
RPI	Radiation Protection Institute
S&T	Science and Technology
SOE	State of the Environment Report
SSGM	Small Scale Gold Mining
UNCD	United Nations Comtrade Database
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UNSD	United Nations Statistics Division
US EPA	United States Environmental Protection Agency
VAT	Value Added Tax
WHO`	World Health Organization
WQI	Water Quality Index
ZGL	Zoomlion Ghana Limited



# Executive Summary

## THE MINAMATA CONVENTION ON MERCURY

The objective of the Minamata Convention (Article 1), is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds (UNEP 2013). Ghana ratified the Minamata Convention on 23<sup>rd</sup> March 2017 as the 40<sup>th</sup> Party. Article 20 of the Convention provides that Parties may following an initial assessment develop and execute an implementation plan. The number of signatories stand at 128 and number of Parties at 92 (June 2018)

## NATIONAL BACKGROUND INFORMATION

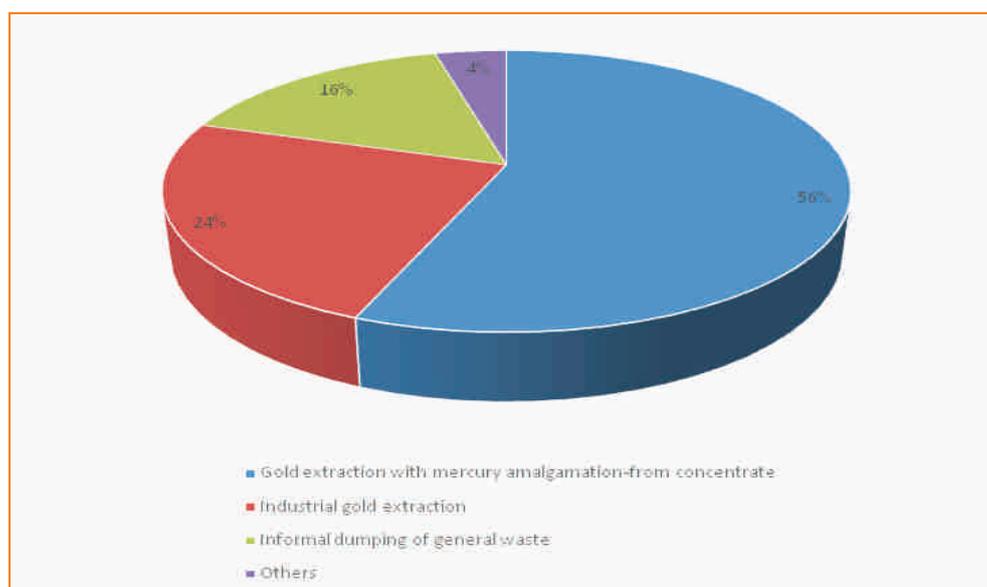
Chapter 1 of the report covers the country profile data for the Republic of Ghana, including information on geography and population; bio-physical environment, political and economic profile, environmental overview, transport, climate change, waste and recycling, waste and recycling, sanitation, air quality, degraded and contaminated sites, soil condition, natural resources, their status and some environmental challenges.

## MERCURY INVENTORY AND IDENTIFICATION OF EMISSIONS AND RELEASES

The survey on mercury releases into the environment of Ghana was conducted countrywide using the UNEP Inventory Toolkit Level 1. A summary of the results for mercury release sources, their emissions and releases pathways are graphically presented below. See Chapter 2 for full details.

### Major Mercury release sources in Ghana

Out of the total estimated mercury input (81,060 Kg Hg/y) from various sources, gold extraction with mercury amalgamation-from concentrate (45,150 Kg Hg/y), industrial gold extraction (19,600kg Hg/y) and informal dumping of general waste(13,162 Kg Hg/y) were identified as the major sources of mercury releases in Ghana. Other sources (3,148Kg Hg/y) identified included open fire waste burning (on landfills and informally, batteries, switches and thermometers. Below is a graphical presentation summarizing the major release sources. Detailed presentation of mercury inputs and releases for all mercury release source types are shown in the following Table 2.4.

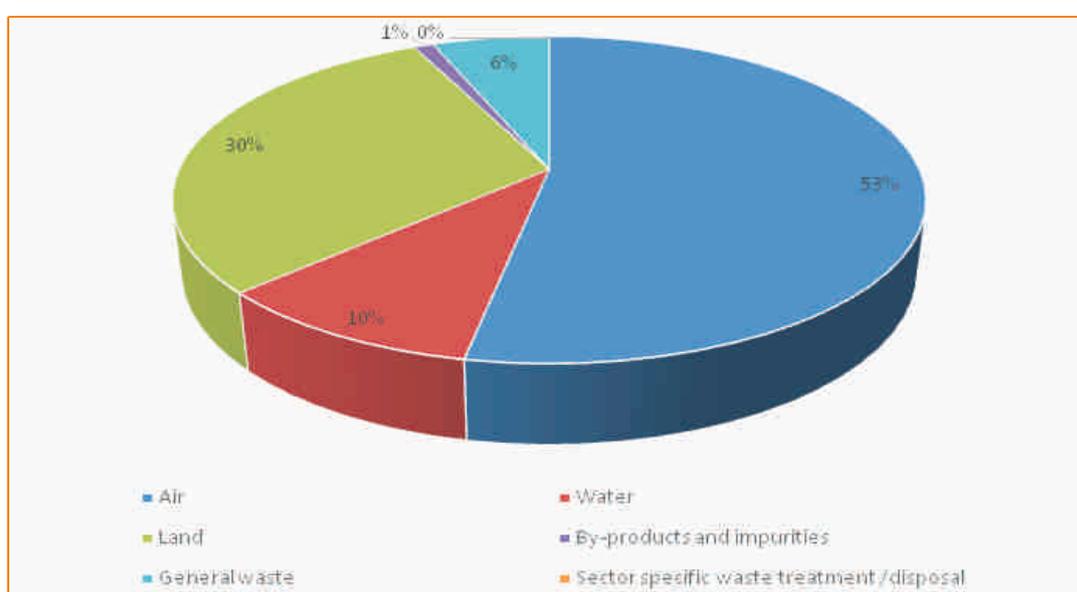


*Mercury release source categories in Ghana*



Through the inventory, it has been realized that an estimated total of 91,070 Kg Hg/y is emitted to the environment from the sources identified above. Out of this total, 48,100Kg Hg/y was emitted to air, 8,870 Kg Hg/y released to water and 27,340Kg Hg/y released to land.

An estimated amount of about 6,760 Kg Hg/y are also released to general waste, by products and impurities and sector specific waste treatment/ disposal systems. (See full details in Table 2.1 in Chapter 2)



*Summary of mercury release and emission pathways*

#### MERCURY STOCKPILES, SUPPLY AND TRADE

Ghana does not mine mercury however, the country imports mercury and mercury containing products. Elemental mercury imported is used largely in Artisanal Small-Scale Gold Mining (ASGM) operations to recover gold. Mercury containing devices are used primarily in educational, research institutions, health care facilities, meteorological services and other allied institutions. The devices are mainly thermometers, manometers, barometers, and sphygmomanometers as well as analytical equipment.

#### POTENTIAL HOTSPOTS

Findings from this study showed that mercury manufacturing /processing was not taking place in Ghana. Most of the mercury releases were from anthropogenic sources. Anthropogenic sources of mercury release such as primary metal production (excl. gold production by amalgamation) and gold extraction with mercury amalgamation from concentrate, are quite significant since gold either through large scale or ASGM are mined in almost all



the regions of Ghana. Consequently, the gold mine regions of Ghana particularly, the Western, Ashanti, Eastern and Central regions, have been identified as 'hot spots' because of intensive industrial and mining activities in the gold extraction industries which have increased significantly the local levels of mercury in the environment particularly on land.

#### POLICY REGULATORY AND INSTITUTIONAL FRAMEWORK ASSESSMENT

A detailed assessment of the existing policy, regulatory and institutional framework relevant to mercury management is provided in Chapter Three.

The assessment of Ghana's legal framework on chemical-related legislation, reveals that there is no single law that comprehensively covers all the provisions of the Convention. However, there are some existing laws, that seek to address some of the challenges posed by mercury that the Convention seeks to address. Significant among them are Act 490 which established the EPA as well as its LI 1652, the Public Health Act, 2012 (Act 851) and various laws governing the mining sector. Including the Minerals and Mining Act 2006 (Act 703) and related regulations.

At the institutional level, Ghana boasts of a number of both public and private institutions that have done considerable work the subject of mercury and its impact on human health and the environment as well as those whose work relate to activities that will ensure the effective implementation of the Convention. Among these institutions are, Environmental Protection Agency, Council for Scientific and Industrial Research, Food and Drugs Authority, and Customs Division of the Ghana Revenue Authority. The Friends of the Nation is an NGO that has done substantial work on ASGM and been actively involved in the MIA process from commencement.

Most institutions including EPA, MOTI, GHS and FDA identified capacity and logistical constraints as a major drawback in carrying out their functions.

Ministries such as those responsible for environment, local governance, labor and employment relations, information, justice and finance have important roles to play in ensuring the successful implementation of the Convention in Ghana.

The National Environmental Policy is a revised version of an earlier one. It has sections dealing with chemicals generally but no specific reference to mercury

#### IDENTIFICATION OF POPULATIONS AT RISK AND GENDER DIMENSIONS

Chapter 4 is devoted to identifying those segments of Ghana's population at risk to mercury exposure as well as the gender dimension in the process. It assesses populations that are at risk to mercury exposure, and how such exposure affects humans differently, particularly vulnerable populations as well as the environment.

#### AWARENESS AND UNDERSTANDING OF WORKERS AND THE PUBLIC

This chapter assesses the level of awareness and understanding of workers with higher risks of exposure to mercury as well as the general public. It also provides information on existing training and education opportunities on the use of mercury-free alternatives, among others. Recommendations for future trainings for specific target groups and professionals such as miners, health workers, traditional authorities, NGOs, waste managers and governmental bodies with respect to specific articles in the Convention are also provided.

#### IMPLEMENTATION PLAN & PRIORITIES FOR ACTION

The following Priority Areas were identified in Chapter 6 for the effective implementation of the Convention:

- PRIORITY 1: Develop a legal framework that incorporates the obligations under the Minamata Convention as well as an administrative structure for its full and effective implementation.



- PRIORITY 2: Phase-out the use of mercury-added products from the health sector (Article 4, Annex A Part I) and Phase down the use of dental amalgam (Article 4, Annex A Part II)
- PRIORITY 3: Reduce and where feasible, eliminate the use of mercury and mercury compounds in ASGM
- PRIORITY 4: Reduce emissions and releases of mercury from point source categories
- Priority5: Manage mercury waste in an

environmentally-sound manner to reduce/eliminate exposure to humans and the environment.

In addition to the aforementioned priorities, further recommendations have been made for the strengthening of scientific institutions to undertake further research on the subject of mercury and its compounds, its effects on human health and the environment, with the aim of strengthening national capacity to effectively implement the convention.



# Introduction

## MERCURY, HUMAN HEALTH AND ENVIRONMENT

Mercury, a chemical element (symbol Hg; atomic number 80) and commonly known as quicksilver, is a dense, silver-white metal that is liquid at ordinary temperatures. There are three forms of mercury in the environment: elemental, inorganic, and organic mercury. It occurs in its elemental form in the earth's crust but is more commonly found in the form of cinnabar (mercury sulphide). It may occur with other non-ferrous sulphide minerals (zinc, lead, arsenic, gold, etc) and in trace quantities or as an impurity in many other economically valuable materials including fossil fuels such as coal, gas, and oil. Mercury combines with most metals to form alloys called amalgams and these decompose on heating with volatilization of the metallic mercury.

As an element, mercury is persistent in the environment and is naturally released into the atmosphere as vapour during processes such as volcanic activity, weathering of rock, water body movement, forest fires, and biological processes. While natural releases continue, they do not account for the considerable increase in environmental mercury levels since the on-set of the industrial age. Significant amounts of mercury are however released from a range of human activities. It is estimated that roughly 10% of the emissions of mercury to the atmosphere are from natural emissions; a further 30% is generated by current human activity; and the remaining 60% is via re-emissions (evaporation, etc.) of mercury already in the environment, mostly as a result of previous human activity (UNEP, 2013). Activities contributing anthropogenic mercury releases include the processing of some base metal ores; the burning of some coals and hydrocarbon fuels; the open use of mercury in industrial processes and in artisanal and small-scale gold mining (ASGM); and the breakage and improper disposal of mercury-containing products.

Mercury and mercuric compounds (particularly methyl mercury) have long been recognized as chemical substances, which have significant adverse health effects on humans and the environment. In

spite of its usefulness in thermometers, barometers, sphygmomanometers, float valves, fluorescent lamps and other devices, mercury is considered by the World Health Organization as one of the top ten chemicals or groups of chemicals of major public health concern (World Health Organization, 2017). Elemental and methyl mercury are toxic to the central and peripheral nervous systems. The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. Harmful effects on unborn children and infants are of particular concern. Ecological effects of mercury include harmful effects on microorganisms even at low concentrations, toxicity to aquatic organisms and birds and physiological, reproductive and biochemical abnormalities in fish exposed to sub-lethal concentrations of mercury. A wide variety of birds fed inorganic mercury show a reduction in food intake and consequent poor growth. Other (subtler) effects in avian receptors have been reported i.e. increased enzyme production, decreased cardiovascular function, blood parameter changes, immune response, kidney function and structure, and behavioural changes (Boening DW, 2000).

## MERCURY AS AN ISSUE IN GHANA

Major sources of releases and emissions of mercury into the natural environment in Ghana are mainly anthropogenic, through (i) combustion of municipal waste containing mercury compounds and mercury containing devices; (ii) incineration of medical waste and (iii) ASGM during the process of amalgamation and burning of the gold amalgam.

The first two modes of release have not yet been thoroughly assessed and therefore, the degree of impacts on human health and the environment are not well documented. However, the releases of mercury and mercury compounds from the artisanal mining sector have been, to a very large extent, documented and found to be of concern to humans



and the environment (Donkor et al., 2006, Wilson, 2015,). The use of mercury in gold extraction, mainly in the ASGM sector, poses serious problem in the mining areas of Ghana. In addition to important releases of mercury, the activities of ASGM have contributed to environmental degradation, dust production, pollution of soils and agricultural sites, diversion of river courses, exposure of large areas to erosion and subsequent release of other heavy metals into waterways.

Nevertheless, ASGM activities have increased steadily since 1989 and the sector now accounts for 30 % of Ghana's total gold output (Minerals Commission Report, 2016). The "gold rush" phenomenon in the ASGM sector leading to a large influx of miners in the various mining towns continues to play an important economic role making it one of the most important livelihood activities, employing an estimated one million people and supporting approximately 4.5 million more (McQuilken and Hilson, 2016).

#### THE MINAMATA CONVENTION ON MERCURY

The overall objective of the Minamata Convention (Article 1) is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds (UNEP 2013).

The Convention was initiated in 2009 by the United Nations Environment Programme (UN Environment) Governing Council, and finally agreed after a series of intergovernmental negotiations meetings, by one hundred and forty-seven (147) Governments on January 19, 2013 in Geneva, Switzerland. The text of the Convention was adopted and opened at the Diplomatic Conference of Plenipotentiaries on the Minamata Convention on Mercury held in Kumamoto and Minamata, Japan, from 7 to 11 October 2013 (UNEP 2013). The Convention entered into force on 16th August 2017, ninety days after the ratification by the fiftieth Party. As at February 2018, there are 128 signatories and 88 Parties to the Convention.

The Preamble of the Convention sets the

background, establishes previous relevant decisions, and cooperative actions. The 35 articles of the Convention can be grouped into 4 main categories: Operation articles, describing obligations to reduce anthropogenic emissions and releases of mercury and mercury compounds to the environment and covering the entire life-cycle of mercury; Support to Parties, financial resources, capacity building, technical assistance and technology transfer, implementation and compliance committee; Information and awareness raising, including actions to reduce impacts of mercury; and Administrative matters. These articles are supported by 5 annexes.

Major highlights of the Minamata Convention include a ban on new mercury mines, the phase-out of existing ones, the phase out and phase down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues. It promotes the use of alternatives and best available techniques and environmental practices across a wide range of products, processes and industries where mercury is used, released or emitted (UNEP, 2013).

Ghana became a signatory to the Minamata Convention on Mercury on 24th September 2014 and ratified it on 23rd March 2017. Ghana's ratification was achieved through a collaborative effort of the United Nations Institute for Training and Research (UNITAR) and funding from the Government of Switzerland.

#### PURPOSE, STRUCTURE AND APPROACH OF MIA DEVELOPMENT, INCLUDING STAKEHOLDER CONSULTATION PROCESS

Article 20 Paragraph 1 states that "Each Party may, following an initial assessment, develop and execute an implementation plan, taking into account its domestic circumstances, for meeting the obligations



under this Convention. Any such plan should be transmitted to the Secretariat as soon as it has been developed”.

The objective of the Minamata Initial Assessment (MIA) is to enable the Government of Ghana establish a sound foundation to undertake future work towards the implementation of the Convention.

An MIA provides an opportunity for a country to undertake a mercury inventory, determine and agree upon the measures it will take to implement the Convention, estimate associated costs and communicate this information in a concise and clear manner. The MIA provides a basis for those parties developing Implementation Plans in accordance with Article 20.

The main components of the MIA report are as follows:

- Assessment of legislation and policies in regard to the implementation of the provisions of Article 3; Article 5; Article 7 (including legislation and policy to cover formalization, worker health and safety); Article 8 (specifically in regard to relevant national air pollution/emission standards and regulations); Article 9 (specifically in regard to the ability to identify and categorize sources of releases).
- Initial Inventory of mercury in the following categories: Stocks of mercury and/or mercury compounds and import and export procedures including an assessment of the storage conditions; supply of mercury, including sources, recycling activities and quantities; sectors that use mercury and the amount per year, including manufacturing processes; ASGM and mercury added products; and trade in mercury and mercury containing compounds.

- Identification of emission sources of mercury; release sources of mercury to land and water.
- Assessment of the institutional and capacity needs to implement the convention including the systems needed to report to the Convention under article 21 and identification and strengthening needs of national institutions required to implement the convention.

Based on the data generated from the development of the MIA, the expected outcomes will be a description of the following key areas:

- National mercury profile, including significant sources of emissions and releases, as well as inventories of mercury and mercury compounds.
- Structures, institutions, legislation already available to implement the Convention
- Barriers that would hinder or prevent implementation.
- Technical and financial needs for implementation of the Convention, including resources from the GEF, national sources, bilateral sources, the private sector and others.

Relevant stakeholders were consulted and participated in the inception of the project, through the data collection, the preparation and the validation of the MIA Report. The list of stakeholders consulted is provided as Annex 1.



# Chapter One

## NATIONAL BACKGROUND INFORMATION

### 1.1 COUNTRY PROFILE

Ghana is located between latitudes 4° 44' and 11° 15' N and longitudes 3° 15' W and 1° 12' E with a land area of 238,539 km<sup>2</sup>. It is bounded to the east by the Republic of Togo and to the west by La Cote d'Ivoire. To the north is Burkina Faso and to the south is the Gulf of Guinea (Figure 1.1).



Figure 1.1: Location Map of Ghana

#### 1.1.1 CLIMATE AND TOPOGRAPHY

The climate of Ghana is tropical, but temperatures vary with season and elevation. Except in the north, two rainy seasons occur from April to July and from September to November.

In the north the rainy season begins in April and lasts until September. Annual rainfall ranges from about 1,100 mm (about 43 in) in the north to about 2,100 mm (about 83 in) in the southeast. The harmattan, a dry desert wind, blows from the northeast from December to March, lowering the humidity and creating hot days and cool nights in the north. In the south the effects of the harmattan are felt in January.

In most areas the highest temperatures occur in March, the lowest in August. The average annual temperature is about 26°C (about 79°F). The annual rainfall is 736.6mm/29".

The topography of Ghana is gently undulating and low in relief with slopes of 3 to 4% dominating. Most of the area lies between 153 and 244 meters above sea level. Under the climax vegetation the slopes are stable. However, when the vegetation is cleared conditions become unstable and high rates of erosion are inevitable.

#### 1.1.2 VEGETATION

Ghana is divided into six vegetation zones namely the Sudan, Guinea and Coastal Savannah zones, the Transitional zone, the deciduous Forest and the moist and Wet Evergreen Zones (Figure 1.2)

The Sudan Savannah covers an estimated area of 1,900 km<sup>2</sup> and consists of short drought and fire resistant deciduous trees interspersed with open savannah grassland. Grass cover is very sparse and in most areas the land is bare and severely eroded.

The Guinea Savannah covers an area of 147,900 km<sup>2</sup>, which is almost two-thirds of the northern part of the country. The vegetation consists typically of a ground cover of grasses of varying heights interspersed with fire resistant, deciduous, broad-leaved trees at the forest margins. These grade into more open grassland with widely spaced shorter trees towards the north.

The Coastal Savannah covers an estimated area of 4500 km<sup>2</sup>. It consists of mainly grassland interspersed with dense thickets often less than 5m high with a few trees. Short and medium grasses are the dominant species.

The Transitional Zone (Derived Savannah) covers about 8,300 km<sup>2</sup>. Most of the tree species, similar to those in the forest zone, occur in association with tall to medium tall grasses.



The Deciduous Forest zone is about 66,300 km<sup>2</sup> in extent and forms about 90% of the total forest zone. The characteristic associations are Celtic-Triplochiton and Antiaris-Chlorophora. The indicator trees for the former consist of Celtic milbraedii and Triplochitonscleroxylon whilst the latter is characterized by Antiarisafricana and Chlorophoraexcelsa.

It is within this zone that most food crops, timber extraction and cocoa cultivation takes place. Most of the timber for both local needs and export, comes from the zone. As a result of these activities, the vegetation outside the forest reserves consists mainly of forest regrowth, thicket, secondary forest and swamp thicket.

The Moist and Wet Evergreen Zone covers an area of about 7,500km<sup>2</sup> and is located in the southwestern

corner of the country. The vegetation is generally evergreen although some species common to the semi-deciduous forest may be found. Such species tend to shed their leaves during the dry season.

The zone is characterized by the Cynometra-Lophira-Tarrietia association with Cynometraananta, Lophiraalata and Tarrietiautilis as indicator trees (Lane, 1962). The topography is undulating to rolling with numerous fresh water swamps potentially suitable for rice cultivation occupying low-lying valley bottoms.

The swamp vegetation consists of Raphia palms with shrubs such as Alchorneacordifolia, Caropaprocera and Macaranga spp. entangled by various climbers.

### 1.1.3 SOILS

The major soils are Lixisols, Acrisols, Nitisols, Luvisols, Plinthosols, Gleysols and Cambisols. Alluvial soils (Fluvisols) and eroded shallow soils (Leptosols) are found in all the ecological zones (Figure 1-3). Most of the soils are developed on thoroughly weathered parent materials.

Their organic matter content, buffering capacity and cation exchange capacity are low. The soils are consequently of low inherent fertility with nitrogen and phosphorus as the most deficient nutrients.

Many of the soils have predominantly light textured surface horizons, heavier textured soils being confined to the valley bottoms and the Accra Plains. In the savanna zones there are extensive areas of iron pan and shallow concretionary and rocky soils, which have low water holding capacities and limited suitability for agriculture. Such areas with low agricultural productivity tends to promote other alternative livelihood ventures such ASGM.



Figure 1.2: Map of Ghana showing vegetation

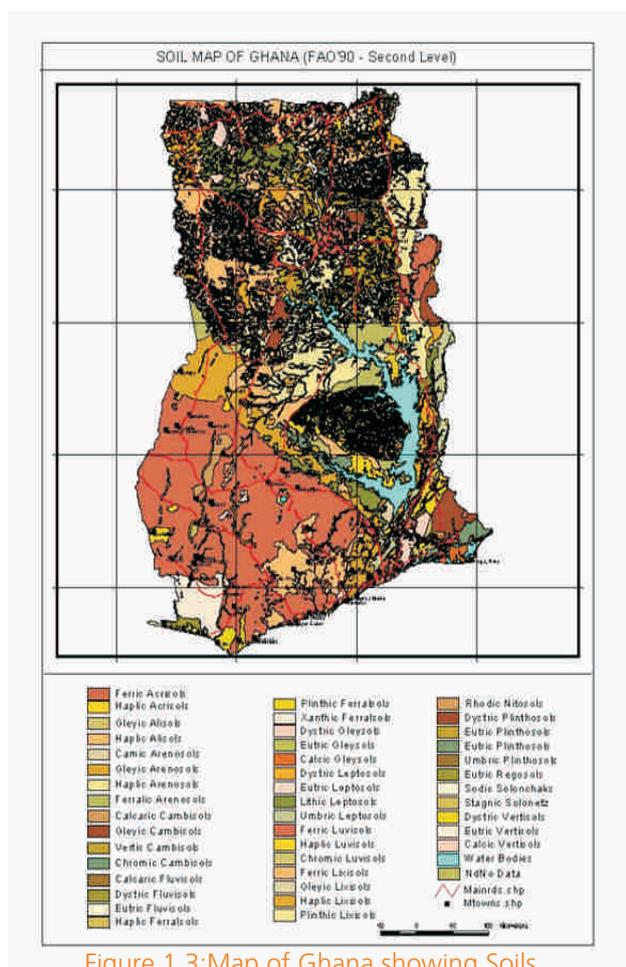


Figure 1.3: Map of Ghana showing Soils

#### 1.1.4 WATER RESOURCES

Ghana's water resources potential is divided into surface and groundwater sources. Surface water resources are mainly from three river systems that drain Ghana, namely: the Volta, South Western and Coastal river systems. The Volta system is made up of the Red, Black and White Volta Rivers as well as the Oti River. The Southwestern river system is made up of the Bia, Tano, Ankobra and Pra rivers. The Tordzie/Aka, Densu, Ayensu, Ochi-Nakwa and Ochi-Amisshah comprise the Coastal river systems.

These river systems make up 70%, 22% and 8% respectively of Ghana's total land area of about 240,000km<sup>2</sup>. In addition to these, the only significant

natural freshwater lake in Ghana is Lake Bosumtwi. This is a meteoritic crater lake located in the forest zone, with a surface area of 50 km<sup>2</sup>, and a maximum depth of 78m. Generally, rainfall decreases from the southwest of the country (2,000 mm/year) towards the north (950 mm/year) and the southeast (800 mm/year).

The total annual runoff is 56.4 billion m<sup>3</sup> with the Volta river accounting for 41.6 billion m<sup>3</sup>. The mean annual runoff from Ghana alone is about 40 billion m<sup>3</sup>. The Volta, Southwestern and Coastal systems contribute 65%, 29% and 6%, respectively, of this runoff. The runoffs are also characterized by wide disparities between the wet season and dry season flows. The total water available from surface water sources is 39.4 billion m<sup>3</sup> per annum.

Ghana is underlain by three main geological formations, namely the basement complex comprising crystalline igneous and metamorphic rocks; the consolidated sedimentary formations underlying the Volta basin (including the limestone horizon) and the mesozoic and cenozoic sedimentary rocks. These formations represent 54%, 45% and 1% of the country respectively.

The depth of aquifers in the basement complex and the Volta basin is normally between 10m to 60m with yields rarely exceeding 6m<sup>3</sup>/h. The aquifer depths in the mesozoic and cenozoic formations are usually between 6m and 120m with average yields of about 184m<sup>3</sup>/h particularly in the limestone aquifer. Groundwater occurrences in limestone formations, which also exist, are much deeper located, typically in the range of 120m to 300m. The average yield in the limestone formation is 180m<sup>3</sup>/h.

#### 1.1.5 HUMAN POPULATION

Ghana recorded a population of 27.6 million in 2015. The population increased from 6.7 million in 1960 to 18.9 million in 2000 and 24.7 million in 2010. The period 2000-2010 recorded an average annual growth rate of 2.7 per cent. The population of Ghana has a sizeable youth component, with a broad base



consisting of large numbers of children and a small number of elderly persons. The structure of the population undergoes changes over time by rejuvenation.

For instance, the proportion of persons under 15 years of age was 38.3 per cent in 2010 and increased to 38.8 per cent in 2015, while the proportion over 65 years of age totaled 4.6 per cent in 2010 and declined to 3.4 percent in 2015.

The proportion of the population living in urban areas has more than doubled in the last five decades, expanding from 23.0 per cent in 1960 to 51.0 per cent in 2010, thus placing greater demand on urban public amenities such as housing, transportation, sanitation, public health and education (Source: United Nations Economic Commission for Africa, Country profile, Ghana 2016).

The Ghanaian population is made up of many ethnic groups. According to the 2010 Population and Housing Census, the breakdown of the ethnic composition was as follows: Akans (47.5%), Mole-Dagbon (16.6%), Ewes (13.9%), Ga-Dangme (7.4%), Guma (5.7%), Guan (3.7%), Grusi (2.5%), Mandre-Busanga (1.1) and others (1.6%).

There are three main religious groupings in Ghana: Christianity, Islam and Traditional. The 2010 census estimated Christianity as the dominant religion in Ghana accounting for over two-thirds (71.2%) of the population followed by Islam (17.6%), Traditional religion (5.2%), other 0.8%, and none (5.2%).

## 1.2 POLITICAL & ECONOMIC PROFILE

### 1.2.1 POLITICAL PROFILE

Ghana is governed under a republican multi-party constitutional democracy. Executive powers are vested in the President while legislative powers rests with a unicameral legislature comprising 275

members of Parliament from single-member constituencies. Elections to the legislature are held every four years. The country has ten administrative regions. These are Ashanti, Brong-Ahafo, Central, Eastern, Greater Accra, Northern, Volta, Upper East, Upper West and Western regions. The country is further divided into 216 districts, which form the basic units of political administration. Districts in Ghana are second-level administrative subdivisions of Ghana, below the level of Region. The local government system consists of a Regional Coordinating Council (RCC), a four-tier Metropolitan and a three-tier Municipal/District Assemblies Structure. The District Assemblies are either Metropolitan (population over 250,000), Municipal (population over 95,000) or District (population 75,000 and over).

The regional coordinating council coordinates and monitors the activities of the Assemblies. The Districts are represented at the regional level (RCC) by the presiding member and the Chief Executive of each assembly.

Within the decentralized context, the Metropolitan or Municipal or District Assemblies, have been entrusted with significant responsibilities related to planning and enforcing the physical development within their boundaries.

The districts are responsible for the provision of basic education, public health, environmental protection, roads, forestry, agricultural extension and sanitation. Planning is shared with the RCCs.

The Central Government, Ministries and Agencies relate to the local government system either directly through the RCC or through the decentralized departments who may form part of the sub-committees of the assemblies.

Through these channels, issues relating to the environment, including mining activities are brought to the attention of the local administration.

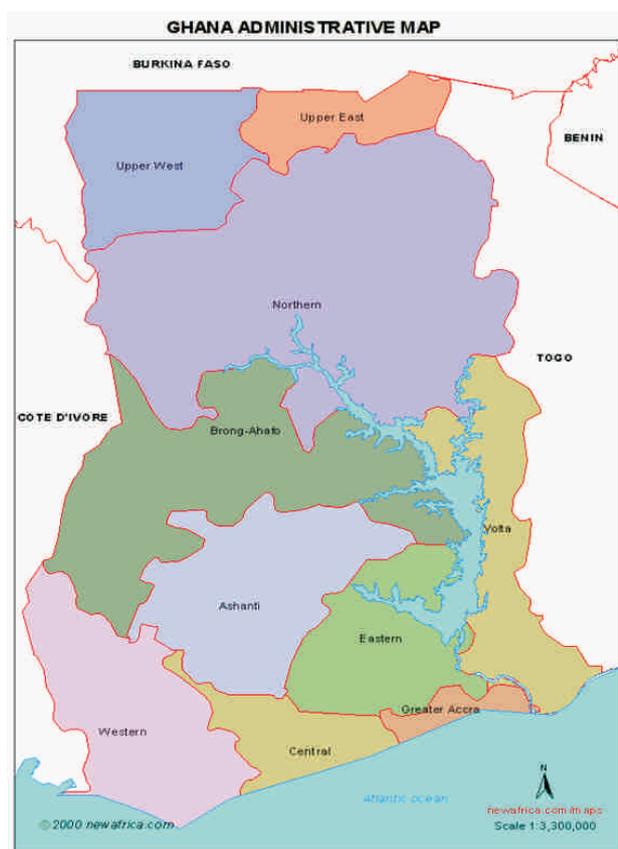


Figure 1.4: Map of Ghana showing Administrative Regions

## 1.2.2 ECONOMIC PROFILE

Ghana's economic performance improved significantly in 2017 after a difficult 2016. The fiscal deficit dropped to 6% of gross domestic product (GDP) in 2017 from 9.3% in 2016, underpinned by serious fiscal consolidation efforts. Despite that total revenue (including grants) underperformed by 1.1% of GDP, the fiscal turnaround was achieved primarily through expenditure cuts (1.3% of GDP), which were imposed on recurrent and capital expenditures. The primary balance improved from a deficit in 2016 to a surplus of 0.8% of GDP in 2017. The debt to GDP ratio is estimated at 69.2% in December 2017 down from 73.4% in 2016 reflecting a slowdown in the rate of external debt accumulation, as well as higher GDP growth. Domestic revenue mobilization is a key priority for the government. According to the Ghana

Statistical Service latest numbers released in April 2018, Ghana's economy is estimated to have expanded by 8.5% in 2017 from 3.6% a year ago driven by the mining and oil sectors. Non-oil growth declined to 4.8% from 5.1% in 2016 as growth in the services sector decelerated in 2017 (World Bank-Ghana at a Glance 2018)

In 2017, the share of Services in overall output was estimated at 55.9 percent, a marginal decline from 56.8 percent registered in 2016. The share of Industry was estimated at 25.6 percent, compared with 24.3 percent in 2016, while that of Agriculture was estimated at 18.5 percent, compared with 18.9 percent recorded in 2016 (Budget statement and economic policy of Ghana 2018).

In terms of growth among the main economic sectors at the end of 2017, Industry was expected to be the best performing sector (17.7%), compared with a negative 1.2% in 2016. The performance in 2017 was largely due to an increased production in upstream oil and gas. Agriculture and the Service sectors were projected to grow by 4.3% and 4.7% respectively at the end of 2017, compared with 3.6% and 5.9% respectively

## 1.2.3 AGRICULTURE

Agriculture is a vital sector to the Ghanaian economy that accounts for significant share in terms of Gross Domestic Product (GDP), employment, foreign exchange earnings and food production. The sector employs about 45.3% of the country's population (ISSER, 2015). It is predominantly smallholder, traditional and rain-fed, with 85% of the country's 1.8 million farms being smaller than 2 hectares.

Only about 12% of Ghana's land is classified as cropped land. Cocoa is the main cash crop and is grown on 40% of the cropped land. It accounts for about 75% of agricultural exports. Other commercially important tree crops are oil palm, coconut, rubber, kola and coffee.

Until the last decade, the agriculture sector was the



major contributor of the country's GDP growth but has been on a continuous decline over the years. While sustainable agricultural production depends primarily on productive soils, the land resources of Ghana, particularly the soil, are being degraded as a result of the interaction of both natural and anthropogenic factors such as illegal mining activities, which leads to the degradation of productive agricultural lands. Illegal mining activities, poses threat to the future development of the agriculture sector, through the destruction of vegetal cover and pollution of water bodies, which are vital for increased agriculture productivity.

Productive agriculture lands are being taken over by small and even large-scale gold mining activities as land owners and farmers some of them being lured away from agriculture see mining as providing substantially greater and quicker earnings than farming. There is no doubt that ASGM activities reduced the amount of agriculture and related activities in area where they are present. Meeting the future food needs of Ghana while reducing poverty and protecting the environment would require stringent measures aimed at halting and reversing activities such as illegal mining that has direct negative impact on soil productivity and surface water quality and quantity.

#### 1.2.4 INDUSTRY

The most important industries include mining and quarrying, lumbering, light manufacturing, textiles, aluminum smelting, food processing, cement, petroleum, construction (roads, buildings etc., among others).

Growth in the Industry Sector for 2017 was projected at 17.7 percent. This was largely driven by the Mining and Quarrying subsector, of which upstream petroleum constitutes a significant share. Upstream petroleum was expected to grow by 69.2 percent in 2017, from negative 16.9 percent recorded in 2016. Manufacturing was estimated to grow by 3.1 percent, compared with 2.7 percent recorded in 2016, as shown in Table 1 Water and Sewerage was

also expected to recover from the contraction of 3.2 percent in 2016 to a positive growth of 2.1 percent in 2017.

Table 1: Industry Growth Performance (percent)

SECTOR	YEARS		
	2015	2016*	2017**
Industry	-0.3	-0.5	17.7
Mining and Quarrying	-6.1	-7.6	52.3
Petroleum	0.9	-16.9	69.2
Manufacturing	2.2	2.7	3.1
Electricity	-10.2	11.7	6.7
Water and Sewerage	20.0	-3.2	2.1
Construction	2.2	2.9	3.7

Sources: Ghana Statistical Service, Ministry of Finance \*Revised \*\*Provisional

#### 1.2.5 GOLD MINING

Mining is an important economic activity in Ghana, contributing significantly to the country's export earnings, government revenues, and employment. The sector contributes about 9 % of government revenue, and the formal mining sector employed some 15,000 workers in 2004 (Minerals Commission, 2004). The Minerals Commission Report (2016) estimates that artisanal and small-scale mining sector employs about 1,000,000 people.

The number of companies granted large-scale mining lease as at 2016 is presented in Table 2 . The 2010 – 2016 periods witnessed an all-time high of 33 leases. Fall in the price of minerals was responsible for less number of companies applying for mining lease between 2000 and 2004. In 2010 however, there was an increase in gold price and the investor environment was conducive hence the number of mines acquiring lease and large concession sizes went up.

Even though large concessions were acquired, only declared mining areas were actually disturbed by mining activities and per Table 2, the size of the declared mining areas is small and measured in acres, compared with the total concession sizes (measured in Km<sup>2</sup>).



According to Minerals Commission, only 50 % of companies that acquire mining lease are normally active. The implication of this is that irrespective of how large the total concession size is, the disturbed area is comparatively always small.

Ghana has launched a nationwide crackdown on illegal mining. In order, to promote best practices in small-scale mining, the central government found it necessary to provide a comprehensive strategy for an integrated small-scale mining industry that will create the basis for sustainable livelihoods. For instance, there could be provision for training for the youth in

Table 2 : Number of mining companies with large-scale leases and concessions

Number of Companies Granted Large Scale Mining Lease	Period	Total Concession Size Km <sup>2</sup>	Total Mining Area Declared (Ha)
12	Before 2000	1,290.17	-
5	2000-2004	897.29	-
11	2005-2009	565.78	3,810.75
33	2010-2016	1724.90	24,261.77

Source: Minerals Commission data 2016

Table 3 shows number of small-scale miners and the total concession sizes granted them between the periods 2012 to 2016. The activities of the illegal small-scale artisanal miners in particular, is more devastating since they operate without due regard to best practices.

Most of the illegal artisanal miners (Galamsey) are involved in alluvial mining along watercourses that result in devastating pollution of rivers, streams and lakes. The use of mercury and cyanide results in the release of toxic chemicals into water bodies and emissions to air.

Table 3: Number of small-scale mines with license and concession		
Year	Number of Small-Scale Licenses Granted	Total Concession Size (Acres)
2012	397	9,093.21
2013	277	5,352.12
2014	99	2,152.62
2015	298	6,283.84
2016	256	5,209.00

Source: Minerals Commission data 2016

small-scale mining technology through effective linkage with technical training institutions.

Possible interventions to overcome these problems include promotion of access

to recommended inputs for production and of block farming schemes, development of supervised input-product marketing credit schemes and establishment of a special revolving fund for production, formation of community co-operatives and credit unions and creation of financial incentives (e.g. review of tax policy to accommodate agricultural subsidies).

#### 1.2.6 THE INDUSTRIAL CHEMICAL INDUSTRY

The chemical industry in Ghana has grown steadily since the advent of the structural adjustment programme in the 1980's and 1990's. This has resulted in an increasing amount of the importation of various types of chemicals both for industrial and agricultural purposes. The main types of chemical imports to Ghana include: petroleum products, various fertilizer types, pesticides, industrial raw materials for processing industries as well as chemicals for the mining industries. Nearly 20 % of the imported chemicals are either formulated or repackaged for sale on the local market. Many of the above-mentioned chemicals find use in the processing/manufacturing industries, petroleum industry and the agricultural industry. It is significant to note that official importation of mercury has



declined in the past several years. According to the official records at the EPA, Ghana imported on the average 11 metric tons of mercury per annum over the past five years. As of the third quarter of 2015, official imports of mercury recorded by the EPA stood at 1.78 MT.

### 1.2.7 HEALTH

Although access to health care generally improved between 2005 to 2013 across all localities and income quintiles, nonetheless, 34 % of the people who reported an illness in 2013, did not seek health care, down from 40.6 % in 2005 (Ghana Living Standards Survey, GLSS). According to Ghana Statistical Service, the mortality rate per 1,000 children under 5 years of age declined from 115 in 1988 to 111 in 2003, and declined further to 60 in 2014.

Similarly, the infant mortality rate per 1,000 live births, declined from 64 in 2003 to 41 in 2014. The overall child mortality rate (children surviving to age 12 months) per 1,000 children also dropped from 84 deaths in 2003 to 19 in 2014. In addition, life expectancy increased from 58.7 years in 2005 to 61 years in 2013.

## 1.3 ENVIRONMENTAL OVERVIEW

The 2016 State of the Environment (SoE) report for Ghana provides key environmental issues relating to human population, economics and environment, energy consumption, transport, climate change, waste and recycling, and sanitation, air quality, degraded and contaminates sites, biodiversity, protected areas and conservation, freshwater resources, wetlands, coastal ecosystems, and marine ecosystem).

### Key environmental issues

The key environmental issues in Ghana according to the State of the Environment report, of 2016, include the following:

### 1.3.1 HUMAN POPULATION

There is an increased trend in urban growth with expansion of built environment, loss of agricultural lands, challenges of poor drainage and flooding, and the issues of waste and land management, human mobility, resources and commodity flows, and energy, water and food supplies. In the major cities, housing delivery has become a major challenge and there is development of slums and informal settlement enclaves with improvised homes, which are characterized by low quality service delivery and poor environmental conditions. It has been estimated that the country would require a total of 2 million dwellings by 2020 (State of the Environment report, of 2016).

### 1.3.2 ECONOMICS AND ENVIRONMENT

Gross domestic Product (GDP) growth has slightly increased in recent years partly as a result of poor value addition and use of local content, and in an environment where production technologies are largely inefficient. Further increase in production will be associated with high resource use, which is detrimental to the environment. The excess of import over exports has led to a widening balance of trade deficit and together with high fiscal deficits, has partially resulted in debts, which are used to finance these deficits.

This situation has impacted negatively on the environment as more natural resources are extracted to finance these debts. Overall, economic indicators have not performed very well and have partially resulted in the slight decrease of the Environmental Performance Index. Reversing the observed trend will require green growth policies that revolves around good governance; formulation of a long-term strategy to guide development; strengthening institutions; human capacity and coordination; better involvement of the private sector; ensuring sustainable consumption and production; improving monitoring, evaluation, finance and research for development (State of the Environment report, of 2016).



### 1.3.3 ENERGY CONSUMPTION

The energy sector is characterized by huge dominance of petroleum consumption and traditional biomass resources. Electricity, biomass and petroleum consumption have seen increasing trends although kerosene consumption has decreased because rural electrification programmes has allowed many rural communities that hitherto used kerosene lanterns, to be connected to the national electricity grid.

Share of renewables (excluding large-scale hydro) was 0.01 % of total electricity generation capacity in 2011. However, this share is expected to rise in the foreseeable future. A general rise in emissions from the energy sector has been observed. This has been attributed to the increasing fuel consumption by the growing number of thermal power generation plants, and within the transport sector due to increasing vehicle fleets and poor fuel quality and efficiency in the road-transport sub-category, as well as rising biomass use in the residential sub-category.

Indeed, the energy sector has been the largest source of anthropogenic CO<sub>2</sub> emissions and recorded an increase of 340 % between 1990 and 2012 (EPA/GEF/UNEP). This underscores the need to diversify the energy sector with a significant proportion of renewable energy to reduce the country's environmental burden of high CO<sub>2</sub> emissions (State of the Environment report, of 2016).

### 1.3.4 CLIMATE CHANGE

Ghana's emissions of Green House Gases (GHG) have increased since 2004. In 2014 Ghana's total GHG emissions, excluding Agriculture, Forestry and Other Land Uses (AFOLU) sector, were estimated to be 16.51 MtCO<sub>2</sub>e. Carbon dioxide has increased by 82 %, Nitrous oxide by 22 % and Methane by 16 %. The mean annual temperature has risen by 1.0 °C since 1960. The number of 'hot' days per year has increased by 13.2 %, while the number of 'hot' nights per year has increased by 20 %. 'Cold' days and nights per year have decreased by 3.3 and 5.1 % respectively. In the

period 2005 – 2010, the period between start and end of rains varied by as much as 30 % from year to year. Sea Surface temperatures are unstable. Ghana aims to become a fully-fledged middle-income country by 2020, but climate change is a serious threat to this ambition. It is already affecting economic output, livelihoods and therefore, long-term development prospects, even though Ghana's own contribution to global climate change has been negligible.

The reason for Ghana's vulnerability is the reliance on sectors that are sensitive to climate change, such as agriculture, forestry and energy production. Evidence already shows the impact of climate change on our national economy, with clear signs that the coastal zone, agriculture and water resources are all negatively affected, with consequent impacts on poverty, health and women's livelihoods (State of the Environment report, of 2016).

### 1.3.5 WASTE AND RECYCLING

Waste generation is increasing due to increasing population, urbanization and economic development. Managing waste in Ghana is a challenge. Currently, solid waste generation across the country is estimated at 13,500 MT per day. From 2005 to 2015, the volume of municipal solid waste generated daily in Accra increased from 1500 to 2800 MT. Over 29 % of households in the country dispose of their solid waste indiscriminately and into drains, curbs, open parks and streams. These have become sources of pollution, negatively impacting human health, water and land quality. Between 55 % and 75 % of solid wastes generated daily in the five largest cities in the country - Accra, Kumasi, Sekondi-Takoradi, Tamale, and Tema, is managed by existing systems. The Agbogbloshie dumpsite is globally popular for the use of crude methods of e-waste recycling, handling and disposal. Between 0.2 % and 0.3 % of the country's total labour force, (20,300 – 33,600) is engaged in this informal electronic waste refurbishing and management sector. In many instances, hazardous waste, which may include mercury waste, is not segregated from domestic waste during disposal (State of the Environment report, of 2016).



### 1.3.6 SANITATION

The sanitation sector has made limited progress over the years and was unable to meet the millennium development goal (MDG) target of 54 % as at 2015. Only 15 % of the population has improved sanitation. Majority of the population (60 %) use shared facilities (public toilets).

The common toilet facilities used in Ghana are the water closet (WC), Kumasi ventilated improved pits (KVIP) and pit latrines. Whereas the use of bucket/pan latrines has been banned; a very small percentage of the population continues to use these facilities. Wastewater treatment is very limited and only 5 % of urban settlements are served with wastewater treatment plants. Some pressures impacting the sector include urbanization, inadequate and aging infrastructure, low investment and climate change. Several policies in both the water and sanitation sectors have been formulated and projects implemented to address the pressures (State of the Environment report, of 2016).

### 1.3.7 AIR QUALITY

Air pollution has become one of the world's top environmental health risks as high concentrations of particulate matter, chemicals or materials adversely affect human health and the environment, causing serious health and economic impacts. Ghana has achieved significant progress at reducing its ozone depleting substances having met its HCFC consumption reduction requirements of 35 % for 2020, ahead of schedule.

Air quality for monitoring data for PM<sub>10</sub> in parts of Accra, though not nationally representative, exceed WHO guidelines of 10 µgm<sup>-3</sup> and the EPA-Ghana standard of 70 µgm<sup>-3</sup>, which is a cause of concern. The transport sector contributes the greatest share of emissions, followed by industry and open/indoor burning activities. The relationship between air pollutants and climate change is also gaining increased recognition. Lack of ambient monitoring data hampers the ability to characterize and understand the

patterns of PM in urban areas to minimize its impacts. Mercury vapours from ASGM, waste burning, and other related activities adversely affect air quality and increased health risks. The country has several legislative and regulatory mechanisms to ensure improved air quality; however, efforts are hampered by inefficiencies resulting from lack of funds, inadequate data and challenges in sharing information between institutions. Supporting policies and investments are recommended for less polluting and more efficient transport, housing, and industries as well as improved power generation, municipal waste management and agricultural practices, for reducing air pollution (State of the Environment report, of 2016).

### 1.3.8 DEGRADED AND CONTAMINATED SITES

There are many anthropogenic activities that cause land contamination such as mining activities; petroleum contamination; landfills and dumpsites. Large-scale mining companies increased from 12 before 2000 to 33 in 2016. Within this period, a total concession size of 4,478.14 km<sup>2</sup> was granted them but only about 28,072.52 ha were subjected to actual mining activities between 2005 – 2016.

Between 2012 – 2016, 1,327 licenses and a total concession size of 28,090.79 ha were granted for small-scale mining. Within the same period, 112 licenses and a concession area of 937.73 acres were granted for sand mining, with 13,889,460 m<sup>3</sup> volume of sand mined. As at November 2016, a total of 259 quarry companies have registered with the Ghana EPA and have been granted a total concession size estimated to be 7,770 acres out of which 3004.4 acres have been the area projected to be disturbed. Large quantities of mine tailings and inorganic pollutants such as arsenic, mercury, cyanide and oxides of Sulphur are generated as waste.

While baseline information on environmental impact of the operations in the oil industry is extremely inadequate, a total of 17 bulk storage depots, comprising 90 tanks are located all over the country and these are in good operational condition. Similarly,



there are 3,452 properly operating discharge retail outlets all over the country that ensure that there is neither spillage nor leakage occurrence. There are only five engineered landfill sites and as many as 216 dumpsites that are not properly designed, constructed or managed. In all this, the major driver is increase in anthropogenic activities that degrade or contaminate sites compounded by lack of law enforcement, as well as the desire for short-term financial gain (State of the Environment report, of 2016).

### 1.3.9 BIODIVERSITY

Ghana is relatively rich in biodiversity, with ca. 5,429 plant species, 983 species of butterflies, 377 species of reptiles and amphibians, 794 bird species and 327 species of mammals. The flora includes 119 threatened species, three of which are critically endangered (CR), 20 endangered (EN) and 96 Vulnerable (VU). The Ghanaian fauna includes 56 species of threatened fish, comprising two CR, 18 EN and 36 VU; 11 species of threatened amphibians, comprising 2 CR, 5 EN and 4 VU; 7 species of threatened reptiles, comprising 2 CR and 5 VU; 22 species of threatened birds, comprising 4 CRR, one EN and 17 VU and 20 threatened mammals, comprising 1 CR, 6 EN and 13 VU. The country's biodiversity is under threat from several human-induced pressures, including habitat loss and degradation resulting from farming, urbanization and extractive industries as well as over-exploitation. Other threats include climate change, invasive species and pollution, particularly with regard to aquatic habitats.

There are indications that the populations of almost all animal species, including invertebrates such as snails, are on the decline and that rodents are now dominating the species exploited as bush meat. Ghana has taken commendable steps to safeguard the country's biodiversity through the establishment of protected areas which currently stands at ca. 16.5% of the country's total land area. Ghana is a party to all the major international treaties that seek to protect biodiversity (State of the Environment report, of 2016).

### 1.3.10 PROTECTED AREAS AND CONSERVATION

Forest conservation in Ghana started in the early 1900s. Since then, relevant institutional and regulatory frameworks have been put in place to ensure that the 8.2 million ha of primary forest coverage for the country remained intact.

The adoption of various policies to regulate the management and utilization of forest and wildlife resources, led to the creation of protected areas. Over the years, anthropogenic drivers have fueled deforestation and forest degradation, with primary forest declining at the rate of 2 % per annum. Currently, only about 1.7 million hectares of primary forest, mainly within the government gazetted protected areas, is left.

The overall forest cover has, however, increased in size through plantation development. This has resulted in the expansion of forest cover from 8,627,402 ha in 1990 to 9,294,349 ha in 2015. Despite this gain, the loss of primary forest cover remains an issue of major concern as strategic habitats are being fragmented, remnant forest patches are getting isolated, biodiversity is eroding and ecosystem services that the forest provide, are being inhibited. More importantly, pressure is being brought to bear on protected areas as there is increasing urge to exploit forest resources from these areas by mining operators (State of the Environment report, of 2016).

### 1.3.11 FRESHWATER RESOURCES

In Ghana, freshwater availability is a limiting factor to ecosystems and functioning of human activities. Water availability, usage, quality and efficient management, require significant attention. Freshwater is affected by several factors including population, land use change, pollution from illegal mining, urbanization and industrial development. These drivers continue to impact on fresh water in significant ways that are likely to affect the sustainability of freshwater. The Water Quality Index



(WQI) of all Ghanaian waters is in decline. Temperature rise, increase in evaporation and rising demand for freshwater in Ghana means that, efforts at sustainable water management must intensify. Investments in the water sector through research (with a focus on datasets) and education that will culminate in reliable projections for demand and quality ought to be pursued (State of the Environment report, of 2016).

#### 1.3.12 WETLANDS

Wetlands particularly in major urban areas are under threat from urbanization and demand for infrastructural development, land for housing, industrial development and farming, pollution from domestic, industrial and agricultural waste, as well as over-exploitation of wetland resources. These pressures have led to significant losses in wetland areas, declines in international status of some wetlands and drastic declines in lagoon fisheries in terms of species diversity and productivity.

Except for the waterbed monitoring that has been ongoing for the past three decades there is no systematic data collection that will enable monitoring of trends and changes in the ecological character of Ghanaian wetlands. However, there are several institutions whose mandates extend to wetland research and which, with adequate resourcing, could collect the data required to inform management prescriptions for key wetlands in the country (State of the Environment report, of 2016). Currently, there are no programmes to monitor mercury trends in wetlands, even though the country may have the capacity to undertake such activity. It is important to institute such monitoring programme in order to meet our obligations under the Convention.

#### 1.3.13 MARINE ECOSYSTEMS AND RESOURCES

Ghana's marine environment is highly productive and supports eighty percent (80 %) of the nation's capture fisheries as well as providing a significant source of employment for local fishermen. Increasing population and urbanization, with associated

economic activities and natural oceanic phenomena, have resulted in increased pressure on the environment causing significant concerns about fisheries depletion, pollution from land based activities and oil/gas activities, habitat degradation, and biodiversity loss.

A number of policy documents such as the Ghana Shared Growth and Development Agenda (GSGDA), the National Climate Change Policy as well as the National Environmental Policy, have provided the framework towards addressing these issues (State of the Environment report, of 2016).

#### 1.3.14 COASTAL ECOSYSTEMS

The coastal area contributes immensely to tourism because of the beaches, castles and fortes found here. Thus, issues pertaining to coastal pollution, resilience and sustainable management of coastal ecosystems, require considerable focus. A total of nine indicators have been selected to assess where we are currently and identify where we want to get to as a country, in relation to effectively managing coastal ecosystems. The status, trends and indicators since the 2004 State of the Environment Report, for most of the coastal ecosystem, shows worsening situations with implications on ecosystem functions.

Drivers influencing interactions within coastal ecosystems include population increase, land use change, pollution, physico-chemical changes, urbanization and industrial development including mining. A growing body of evidence indicates that local air and sea temperatures, wind patterns, ocean current speed and upwelling regimes, are all being affected by human mediated climate change. In addition, the anthropogenic activities mentioned earlier, act synergistically with climate change to place pressure on coastal ecosystems and their biota (State of the Environment report, of 2016).

# Chapter Two



## MERCURY INVENTORY AND IDENTIFICATION OF EMISSIONS AND SOURCES

This chapter focuses on the countrywide inventory on mercury releases into the Ghanaian environment, which was conducted from April to December 2017.

Several methods for data collection were used, such as administration of questionnaires, internet search on websites of various organizations and institutions, telephone interviews, e-mailing, face-to-face interviews with the relevant stakeholders and major players whose activities contribute to the release of mercury into the environment, as well as published reports. Information and data were mostly independently verified. However, it should be noted that some of the information and data provided by certain relevant stakeholders/sectors could have been over or under-estimated.

Stakeholders that made data available for the different sectors highlighted in the Toolkit Inventory Level 1 including the Ghana Statistical Service, Ghana Chamber of Mines, MMDA's, Ministry of Trade and Industry, Ministry of Local Government and Rural Development, Ministry of Health, UN Comtrade Database, Ghana Revenue Authority, Ghana National Petroleum Corporation, Ghana National Gas Company, Ghana Crematorium Association, Environmental Protection Agency, Minerals Commission of Ghana, Ministry of Finance, Ghana National Association of Small Scale Miners, and many others.

This inventory on mercury releases was prepared using the "Toolkit for identification and quantification of mercury releases" made available by the Chemicals Division of the United Nations Environment Programme's (UNEP Chemicals). The Toolkit is available at UN Environment's Toolkit website:

<http://web.unep.org/chemicalsandwaste/what-we-do/technology-and-metals/mercury/toolkit-identification-and-quantification-mercury-releases>

This inventory was developed using the Toolkits Inventory Levels 1 and 2. The Toolkit is based on mass balances for each mercury release source type. The Toolkits Inventory Level 1 and 2 works with predetermined factors used in the calculation of mercury inputs to society and releases, the so-called default input factors and default output distribution factors. These factors were derived from data on mercury inputs and releases from such mercury source types available in literature and other relevant data sources.

The results of the inventory were derived based on the outputs from the Toolkits. The results are presented as follows: summary of the mercury releases from the main group sources, followed by mercury releases from different sources and sub-categories within each source, definitions of mercury release pathways (air, water and land) and finally data acquisition sources and gaps.

Based on the results of the inventory obtained from the various source categories, the total input of mercury in Ghana was approximately 81,060 kg Hg/y. The major source of mercury input into the environment was gold extraction with mercury amalgamation- from concentrate (45,150.0 kg Hg/y) followed by primary metal production (excluding gold production by amalgamation) that accounted for mercury emissions and releases of an estimated quantity of 19,681.0 kg Hg/y, followed by use and disposal of other products (11,989.0 kg Hg/y) and then waste incineration and open waste burning (9,311 kg hg/y) in that order.

## 2.2 RESULTS AND DISCUSSION

An aggregated presentation of the results for main groups of mercury release sources is presented in Table 2.1 below.

**Table 2-1 EXECUTIVE SUMMARY OF MERCURY RELEASES AND SOURCES**

Source category	Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y							Percent of total releases
		Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal	Total releases	
Coal combustion and other coal use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Other fossil fuel and biomass combustion	1,219.2	1,219.2	0.0	0.0	0.0	0.0	0.0	1,219	1%
Oil and gas production	73.9	8.8	14.6	0.0	17.1	0.0	20.1	61	0%
Primary metal production (excl. gold production by amalgamation)	19,680.8	796.1	400.1	17,640.0	784.0	52.5	8.1	19,681	22%
Gold extraction with mercury amalgamation	45,150.0	32,547.9	6,526.8	6,075.3	0.0	0.0	0.0	45,150	50%
Other materials production	41.0	20.5	0.0	0.0	20.5	0.0	0.0	41	0%
Chlor-alkali production with mercury-cells	-	-	-	-	-	-	-	0	0%
Other production of chemicals and polymers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Production of products with mercury content	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Application, use and disposal of dental amalgam fillings	107.4	2.1	47.3	8.6	6.4	21.5	21.5	107	0%



Use and disposal of other products	11,988.8	2,857.3	563.0	3,150.4 30	0.0	5,169.0	249.1	11,989	13%
Production of recycled metals	40.5	13.4	0.0	13.8	0.0	13.4	0.0	41	0%
Waste incineration and open waste burning	9,311.1	9,308.4	0.0	0.0	0.0	0.0	2.7	9,311	10%
Waste deposition	733.8	7.3	0.1	0.0	-	-	-	7	0%
Informal dumping of general waste	13,162.2	1,316.2	1,316.2	10,529.7	-	-	-	2,632	3%
Waste water system/treatment	3,738.0	0.0	3,364.2	0.0	0.0	373.8	0.0	374	0%
Crematoria and cemeteries	450.0	0.0	0.0	450.0	0.0	0.0	0.0	450	0%
<b>TOTALS</b>	<b>81,060</b>	<b>48,100</b>	<b>8,870</b>	<b>27,340</b>	<b>830</b>	<b>5,630</b>	<b>300</b>	<b>91,060</b>	<b>100%</b>



### 2.3 Mercury release source types in Ghana

source types positively identified as present are included in the quantitative assessment.

Table 2.2 shows which mercury release sources were identified as present or absent in the country. Only

Table 2.2 Mercury Sources Identified	
Source category	Source present?
	Y/N/?
<b>Energy consumption</b>	
Coal combustion in large power plants	N
Coal combustion in coal fired industrial boilers	N
Other coal uses	?
Combustion/use of petroleum coke and heavy oil	?
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	Y
Use of raw or pre-cleaned natural gas	Y
Use of pipeline gas (consumer quality)	N
Biomass fired power and heat production	Y
Charcoal combustion	Y
<b>Fuel production</b>	
Oil extraction	Y
Oil refining	Y
Extraction and processing of natural gas	Y
<b>Primary metal production</b>	
Mercury (primary) extraction and initial processing	N
Production of zinc from concentrates	N
Production of copper from concentrates	N
Production of lead from concentrates	N



Gold extraction by methods other than mercury amalgamation	Y
Alumina production from bauxite (aluminium production)	Y
Primary ferrous metal production (pig iron production)	N
Gold extraction with mercury amalgamation - from whole ore	N
Gold extraction with mercury amalgamation - from concentrate	Y
<b>Other materials production</b>	
Cement production	Y
Pulp and paper production	N
<b>Production of chemicals</b>	
Chlor-alkali production with mercury-cells	N
VCM production with mercury catalyst	N
Acetaldehyde production with mercury catalyst	N
<b>Production of products</b>	
Hg thermometers (medical, air, lab, industrial etc.)	N
Electrical switches and relays with mercury	N
Light sources with mercury (fluorescent, compact, others: see guideline)	N
Batteries with mercury	N
Manometers and gauges with mercury	N
Biocides and pesticides with mercury	N
Paints with mercury	N
Skin lightening creams and soaps with mercury chemicals	N
<b>Use and disposal of products</b>	
Dental amalgam fillings ("silver" fillings)	Y
Thermometers	Y
Electrical switches and relays with mercury	Y
Light sources with mercury	Y



Batteries with mercury	Y
Polyurethane (PU, PUR) produced with mercury catalyst	Y
Paints with mercury preservatives	?
Skin lightening creams and soaps with mercury chemicals	?
Medical blood pressure gauges (mercury sphygmomanometers)	?
Other manometers and gauges with mercury	Y
Laboratory chemicals	Y
Other laboratory and medical equipment with mercury	Y
<b>Production of recycled of</b>	
Production of recycled mercury ("secondary production")	N
Production of recycled ferrous metals (iron and steel)	Y
<b>Waste incineration</b>	
Incineration of municipal/general waste	N
Incineration of hazardous waste	y
Incineration / burning of medical waste	Y
Sewage sludge incineration	N
Open fire waste burning (on landfills and informally)	Y
<b>Waste deposition/landfilling and waste</b>	
Controlled landfills/deposits	Y
Informal dumping of general waste	Y
Waste water system/treatment	Y
<b>Crematoria and cemeteries</b>	
Crematoria	Y
Cemeteries	Y



Table 2.3 Miscellaneous potential mercury sources not included in the quantitative inventory with preliminary indication of possible presence in Ghana

Source category	Source present?
	Y/N/?
Combustion of oil shale	N
Combustion of peat	N
Geothermal power production	N
Production of other recycled metals	N
Production of lime	N
Production of light weight aggregates (burnt clay nuts for building purposes)	N
Production of other chemicals (than chlorine and sodium hydroxide) in Chlor-alkali facilities with mercury-cell technology	N
Polyurethane production with mercury catalysts	N
Seed dressing with mercury chemicals	N
Infra red detection semiconductors	N
Bougie tubes and Cantor tubes (medical)	N
Educational uses	N
Gyroscopes with mercury	N
Vacuum pumps with mercury	N
Mercury used in religious rituals (amulets and other uses)	N
Mercury used in traditional medicines (ayurvedic and others) and homeopathic medicine	N
Use of mercury as a refrigerant in certain cooling systems	N
Light houses (levelling bearings in marine navigation lights)	N
Mercury in large bearings of rotating mechanic parts in for example older waste water treatment plants	N



Tanning		N
Pigments		N
Products for browning and etching steel		N
Certain colour photograph paper types	35	N
Recoil softeners in rifles		N
Explosives (mercury-fulminate a.o.)		N
Fireworks		N
Executive toys		N

## 2.4 SUMMARY OF MERCURY INPUTS TO GHANA

Mercury inputs into the Ghanaian environment represent the potential releases of mercury through various economic activities in the country. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, fluorescent light bulbs, etc. It also includes mercury mobilized via extraction and use of raw materials, which contain mercury in trace concentrations.

In the individual mercury release sub-categories, the order of contributions to mercury inputs was (from greatest to smallest): gold extraction with mercury amalgamation-from concentrate (45,150 kg Hg/y), industrial gold extraction (19,600 kg Hg/y), informal dumping of general waste (13,162 kg Hg/y), open fire waste burning (on landfills and informally), batteries, switches and thermometers also constituted significant fluxes of mercury. Detailed presentation of mercury inputs and releases for all mercury release source types present in the country, are shown in the following sections of this report (Table 2.4).



**Table 2.4 Summary of mercury inputs**

Source category	Source present?			Estimated Hg input, kg Hg/y
	Y/N/?	Activity rate	Unit	Standard estimate
<b>Energy consumption</b>				
Other coal uses	?	0	Coal used, t/y	?
Combustion/use of petroleum coke and heavy oil	?	0	Oil product combusted, t/y	?
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	Y	3,356,549	Oil product combusted, t/y	18
Use of raw or pre-cleaned natural gas	Y	1,267,072,000	Gas used, Nm <sup>3</sup> /y	127
Biomass fired power and heat production	Y	35,806,700	Biomass combusted, t/y	1,074
Charcoal combustion	Y	0	Charcoal combusted, t/y	0
<b>Fuel production</b>				
Oil extraction	Y	4,667,310	Crude oil produced, t/y	16
Oil refining	Y	359,584	Crude oil refined, t/y	1
Extraction and processing of natural gas	Y	568,502,528	Gas produced, Nm <sup>3</sup> /y	57
<b>Primary metal production</b>				
Gold extraction by methods other than mercury amalgamation	Y	19,600,000	Gold ore used, t/y	19,600
Alumina production from bauxite (aluminium production)	Y	161,500	Bauxite processed, t/y	81
Gold extraction with mercury amalgamation - from concentrate	Y	42,000	Gold produced, kg/y	45,150
<b>Other materials production</b>				



Cement production	Y	350,000	Cement produced, t/y	41
<b>Use and disposal of products with mercury content</b>				
Dental amalgam fillings ("silver" fillings)	Y	24,223,431	Number of inhabitants	107
Thermometers	Y	850,750	Items sold/y	851
Electrical switches and relays with mercury	Y	24,223,431	Number of inhabitants	2,052
Light sources with mercury	Y	10,255,594	Items sold/y	178
Batteries with mercury	Y	26	t batteries sold/y	7,663
Polyurethane (PU, PUR) produced with mercury catalyst	Y	24,223,431	Number of inhabitants	440
Paints with mercury preservatives	?	0	Paint sold, t/y	?
Skin lightening creams and soaps with mercury chemicals	?	0	Cream or soap sold, t/y	?
Medical blood pressure gauges (mercury sphygmomanometers)	?	0	Items sold/y	?
Other manometers and gauges with mercury	Y	24,223,431	Number of inhabitants	73
Laboratory chemicals	Y	24,223,431	Number of inhabitants	147
Other laboratory and medical equipment with mercury	Y	24,223,431	Number of inhabitants	586
<b>Production of recycled of metals</b>				
Production of recycled ferrous metals (iron and steel)	Y	36,823	Number of vehicles recycled/y	41
<b>Waste incineration</b>				
Incineration of hazardous waste	Y	1,120	Waste incinerated, t/y	27
Incineration / burning of medical waste	Y	844	Waste incinerated, t/y	20



Open fire waste burning (on landfills and informally)	Y	1,852,800	Waste burned, t/y	9,264
<b>Waste deposition/landfilling and waste water treatment</b>				
Controlled landfills/deposits	Y	146,766	Waste landfilled, t/y	734
Informal dumping of general waste	Y	2,632,434	Waste dumped, t/y	13,162
Waste water system/treatment	Y	712,000,000	Waste water, m3/y	3,738
<b>Crematoria and cemeteries</b>				
Crematoria	Y	9	Corpses cremated/y	0
Cemeteries	Y	180,000	Corpses buried/y	450
<b>TOTAL of quantified inputs</b>				<b>81,060</b>

## 2.5 SUMMARY OF MERCURY RELEASES

releases to water (marine and freshwater bodies, including via wastewater systems); land; general waste; and sectors specific to waste treatment.

In the Table 2-5 below, a summary of mercury emissions and releases from all source sub-categories is presented. The key mercury emissions and releases pathways are: emissions to air (the atmosphere); and

An additional output pathway is "by-products and impurities", which designate mercury flows back into the trade. See Table 2.5 below for a more detailed description and definition of the output pathways.



Table 2.5 Summary of releases						
Source category	Estimated Hg releases, standard estimates, kg Hg/y					
	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
<b>Energy consumption</b>						
Other coal uses	?	?	?	?	?	?
Combustion/use of petroleum coke and heavy oil	?	?	?	?	?	?
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	18.5	0.0	0.0	0.0	0.0	0.0
Use of raw or pre-cleaned natural gas	126.7	0.0	0.0	0.0	0.0	0.0
Use of pipeline gas (consumer quality)	-	-	-	-	-	-
Biomass fired power and heat production	1,074.2	0.0	0.0	0.0	0.0	0.0
Charcoal combustion	0.0	0.0	0.0	0.0	0.0	0.0
<b>Fuel production</b>						
Oil extraction	0.0	3.2	0.0	0.0	0.0	0.0
Oil refining	0.3	0.0	0.0	0.0	0.0	0.2
Extraction and processing of natural gas	8.5	11.4	0.0	17.1	0.0	19.9
<b>Primary metal production</b>						
Gold extraction by methods other than mercury amalgamation	784.0	392.0	17,640.0	784.0	0.0	0.0
Alumina production from bauxite (aluminium production)	12.1	8.1	0.0	0.0	52.5	8.1
Gold extraction with mercury amalgamation - from concentrate	32,547.9	6,526.8	6,075.3	0.0	0.0	0.0
<b>Other materials production</b>						
Cement production	20.5	0.0	0.0	20.5	0.0	0.0
<b>Use and disposal of products with</b>						



<b>mercury content</b>						
Dental amalgam fillings ("silver" fillings)	2.1	47.3	8.6	6.4	21.5	21.5
Thermometers	170.2	255.2	170.2	0.0	255.2	0.0
Electrical switches and relays with mercury	615.5	0.0	820.7	0.0	615.5	0.0
Light sources with mercury	53.3	0.0	53.3	0.0	71.1	0.0
Batteries with mercury	1,915.7	0.0	1,915.7	0.0	3,831.5	0.0
Polyurethane (PU, PUR) produced with mercury catalyst	87.9	44.0	175.9	0.0	131.9	0.0
Paints with mercury preservatives	?	?	?	?	?	?
Skin lightening creams and soaps with mercury chemicals	?	?	?	?	?	?
Medical blood pressure gauges (mercury sphygmomanometers)	?	?	?	?	?	?
Other manometers and gauges with mercury	14.7	22.0	14.7	0.0	22.0	0.0
Laboratory chemicals	0.0	48.4	0.0	0.0	48.4	49.8
Other laboratory and medical equipment with mercury	0.0	193.4	0.0	0.0	193.4	199.3
<b>Production of recycled of metals</b>						
Production of recycled ferrous metals (iron and steel)	13.4	0.0	13.8	0.0	13.4	0.0
<b>Waste incineration</b>						
Incineration of hazardous waste	24.2	0.0	0.0	0.0	0.0	2.7
Incineration / burning of medical waste	20.3	0.0	0.0	0.0	0.0	0.0
Open fire waste burning (on landfills and informally)	9,264.0	0.0	0.0	0.0	0.0	0.0
<b>Waste deposition/landfilling and waste water treatment</b>						
Controlled landfills/deposits	7.3	0.1	0.0	-	-	-
Informal dumping of general waste	1,316.2	1,316.2	10,529.7	-	-	-



Waste water system/treatment	0.0	3,364.2	0.0	0.0	373.8	0.0
<b>Crematoria and cemeteries</b>						
Crematoria	0.0	0.0	0.0	-	0.0	0.0
Cemeteries	0.0	0.0	450.0	-	0.0	0.0
<b>TOTAL of quantified releases</b>	<b>48,100.0</b>	<b>8,870.0</b>	<b>27,340.0</b>	<b>830.0</b>	<b>5,630.0</b>	<b>300.0</b>

### 2.5.1 RELEASES TO AIR

In total, 48,100.0 kg Hg/y of mercury was emitted to air in Ghana. As expected, gold extraction with mercury amalgamation-from concentrate, waste incineration and open fire waste burning (on landfills and informally), batteries with mercury, fossil fuel and

biomass combustion, primary metal production (excluding gold production by amalgamation), use and disposal of other products accounted for the most significant releases of mercury to air. Contributions from other source categories are presented in Figure 2.1 to 2.6.

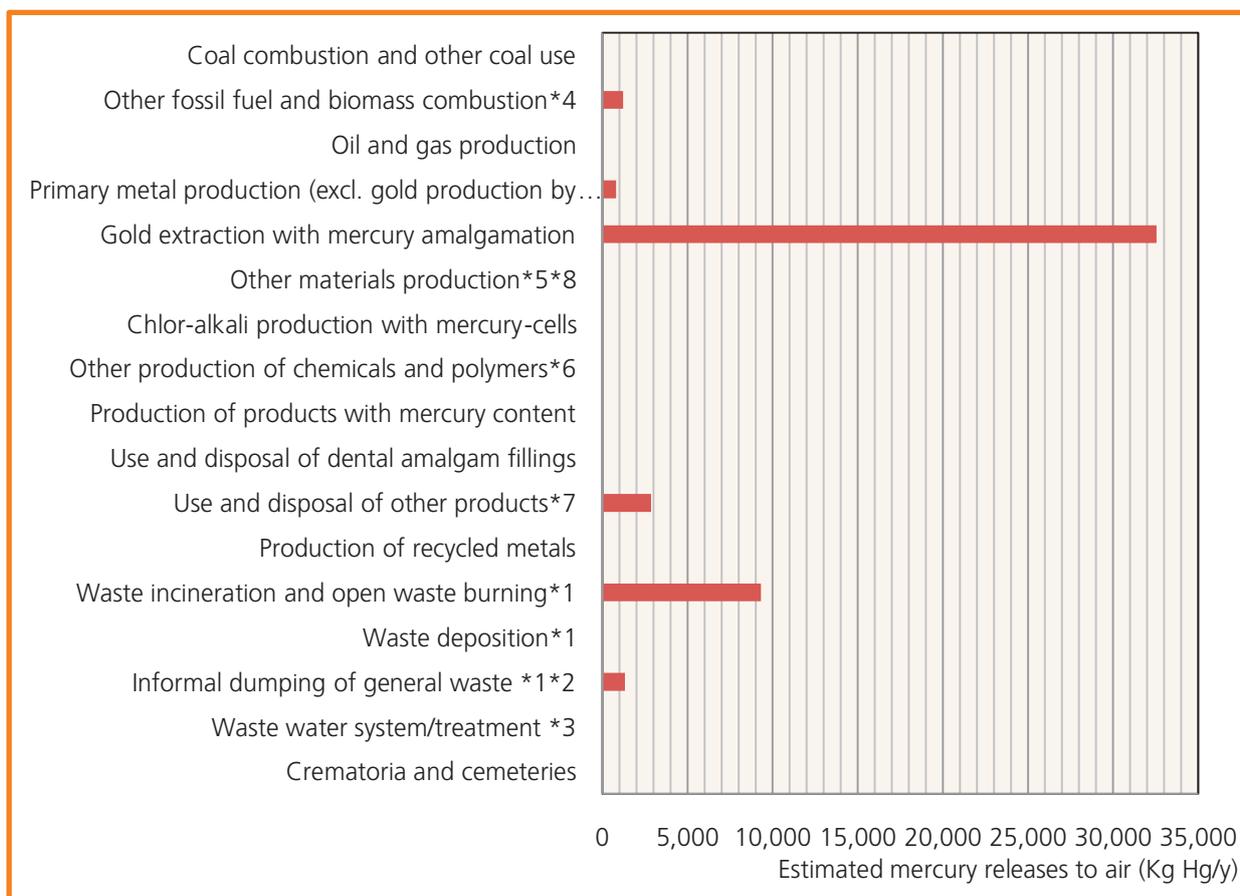


Figure 2.1: Sources of mercury emission to air



### 2.5.2 RELEASES TO WATER

The total amount of mercury releases to water per annum was 8,870 kg/y, with the most significant sources being gold extraction with mercury amalgamation from concentrate, waste water

system/treatment, informal dumping of general waste, primary metal production (excluding gold production by amalgamation), use and disposal of other products, use and disposal of dental amalgam fillings etc.

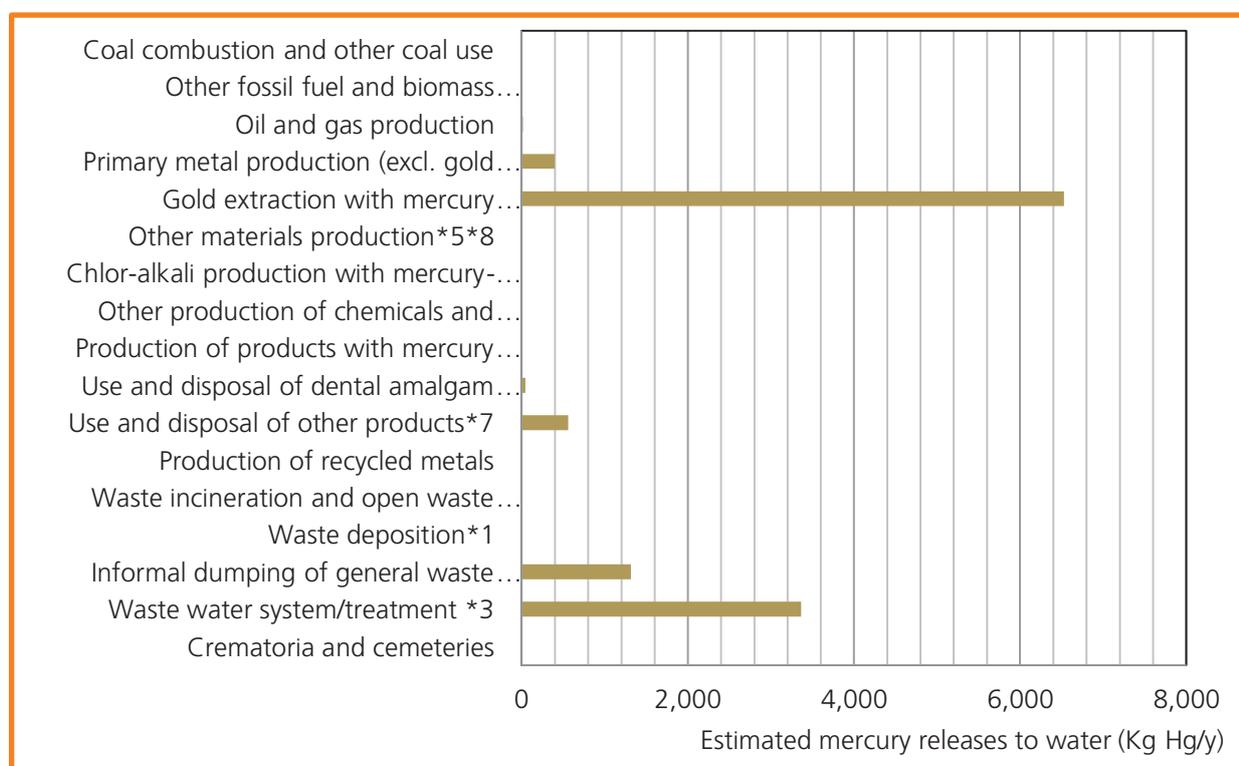


Figure 2.2: Sources of mercury releases to water



### 2.5.3 RELEASES TO LAND

In total, 27,340 kg Hg/y was released to land, with the main source types being primary metal production (excluding gold production by

amalgamation), gold extraction with mercury amalgamation, informal dumping of general waste, batteries with mercury, use and disposal of other products and cemeteries.

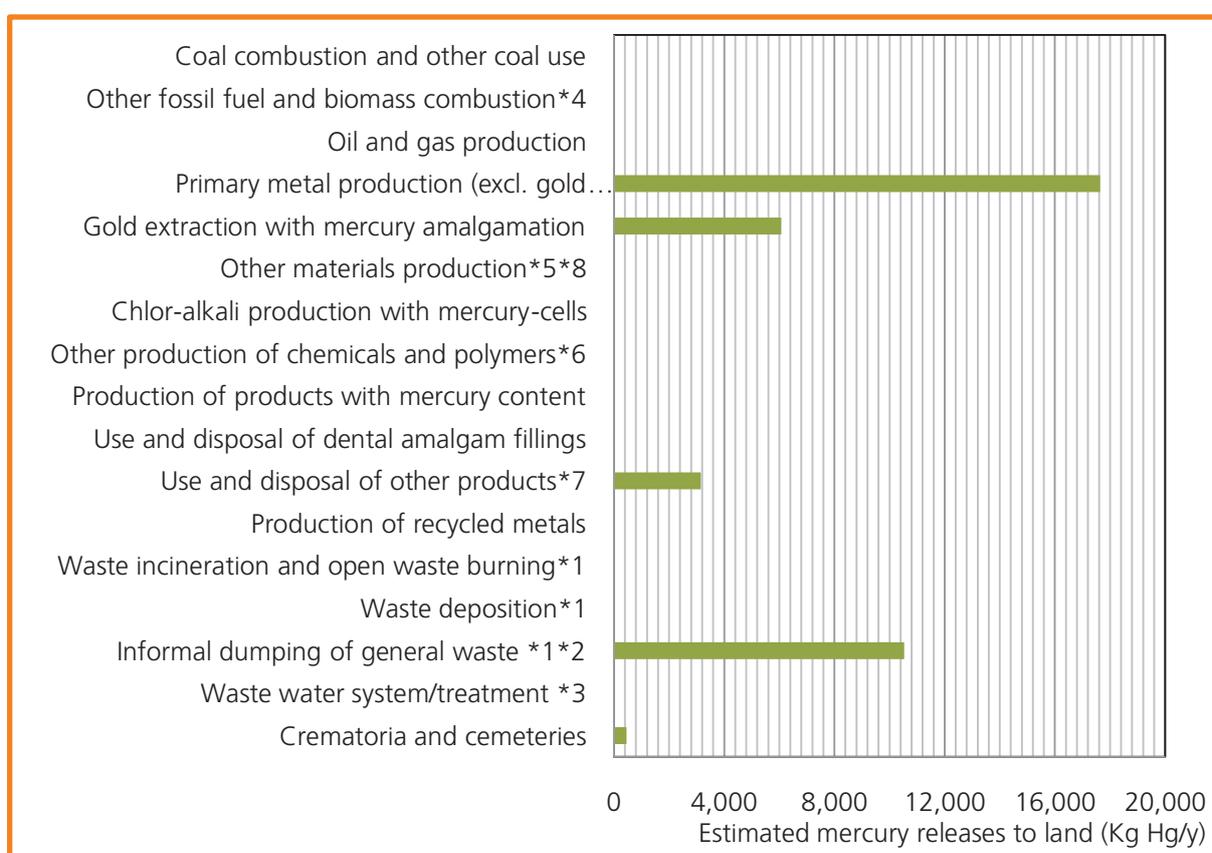


Figure 2.3: Sources of mercury releases to Land



#### 2.5.4 RELEASES TO BY-PRODUCTS AND IMPURITIES

The following source sub-categories, namely; primary metal production (excluding gold production by

amalgamation), other material production, oil and gas production, use and disposal of dental amalgam fillings, etc. accounted for 830 kg Hg/y.

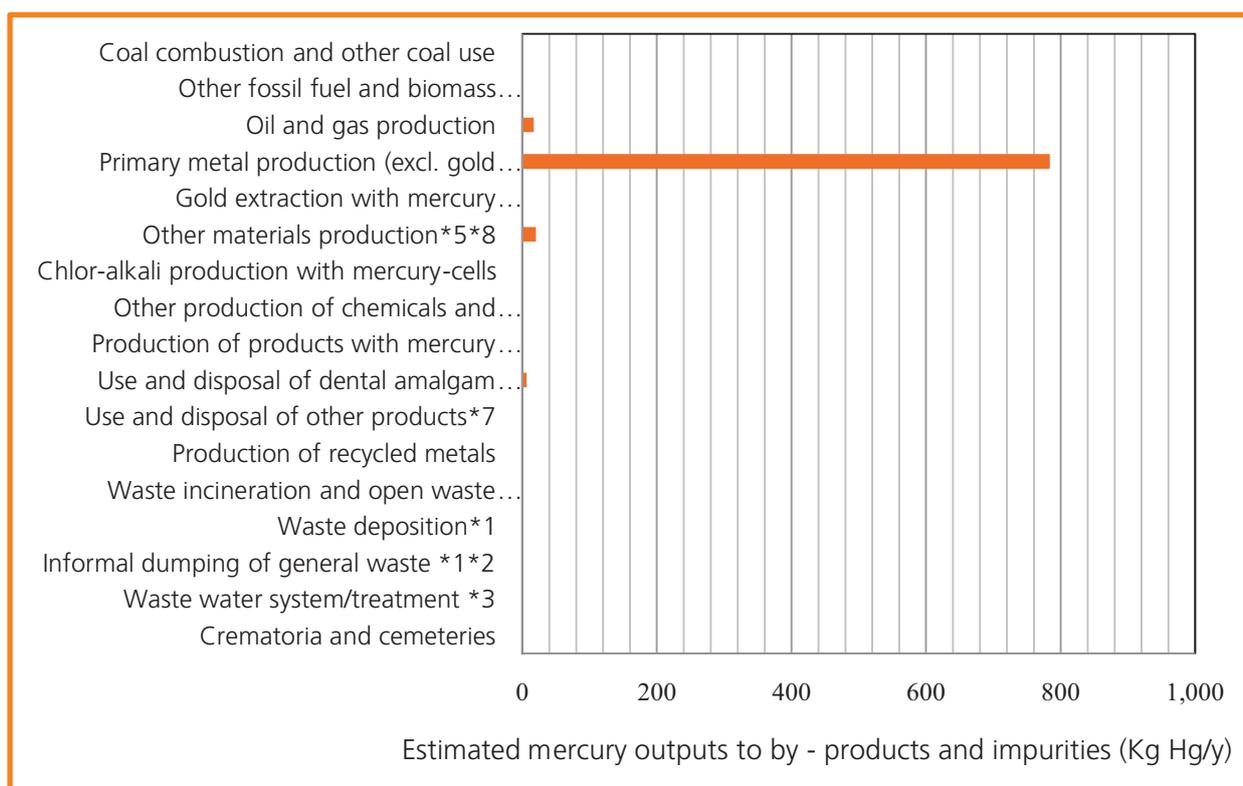


Figure 2.4: Sources of mercury releases as a result of by-products and impurities (above)

#### 2.5.5 RELEASES TO GENERAL WASTE

The total amount of release to general waste per annum is 5,630 kg Hg/y with the following sub-categories being the major sources: use and disposal

of other products, wastewater systems/treatment, primary metal production (excluding gold production by amalgamation), use and disposal of dental amalgam fillings, production of recycled.

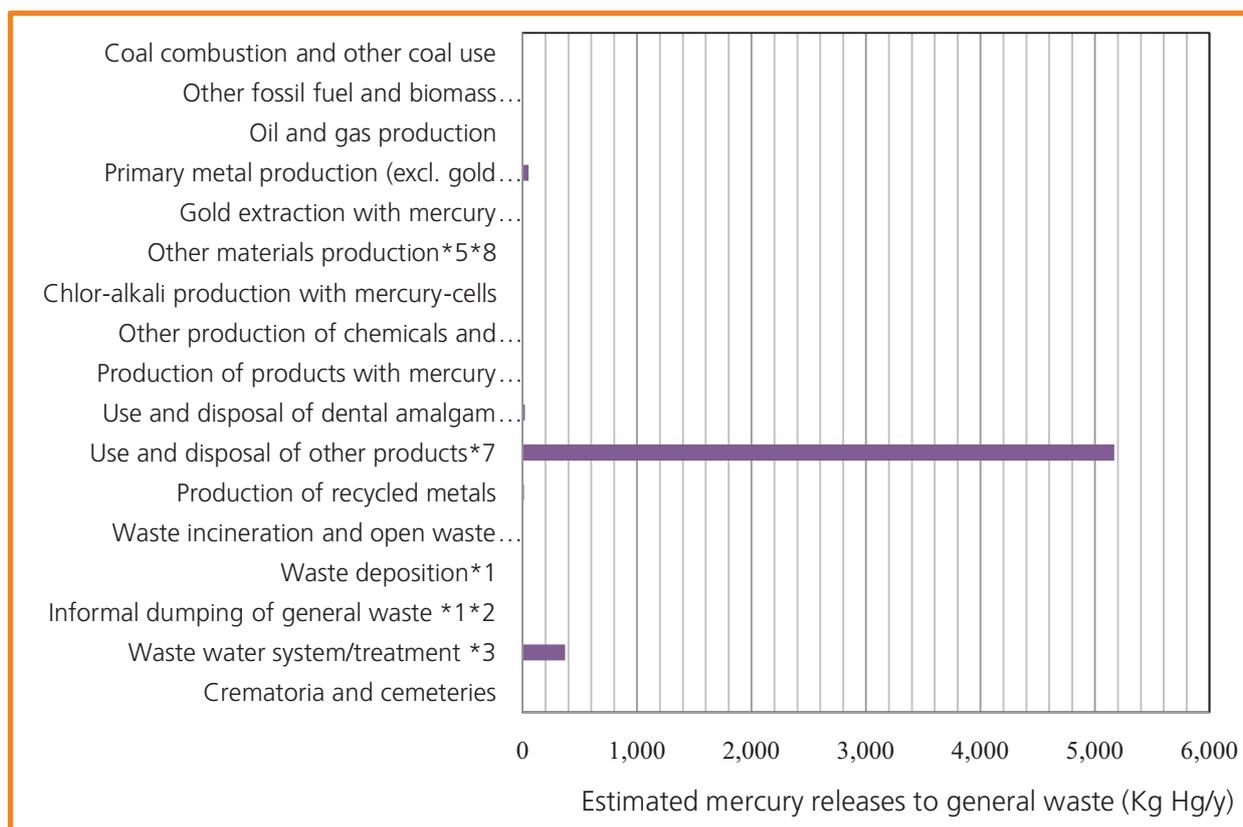


Figure 2.5: Sources of mercury releases as a result to general waste.

#### 2.5.6 RELEASES TO SECTOR SPECIFIC WASTE TREATMENT/DISPOSAL

The total annual releases to waste treatment was 300 kg Hg/y with the main sources being Use and disposal of other products with mercury, use and

disposal of dental amalgam fillings, oil and gas production, primary metal production (excluding gold production by amalgamation), waste incineration and open waste burning.

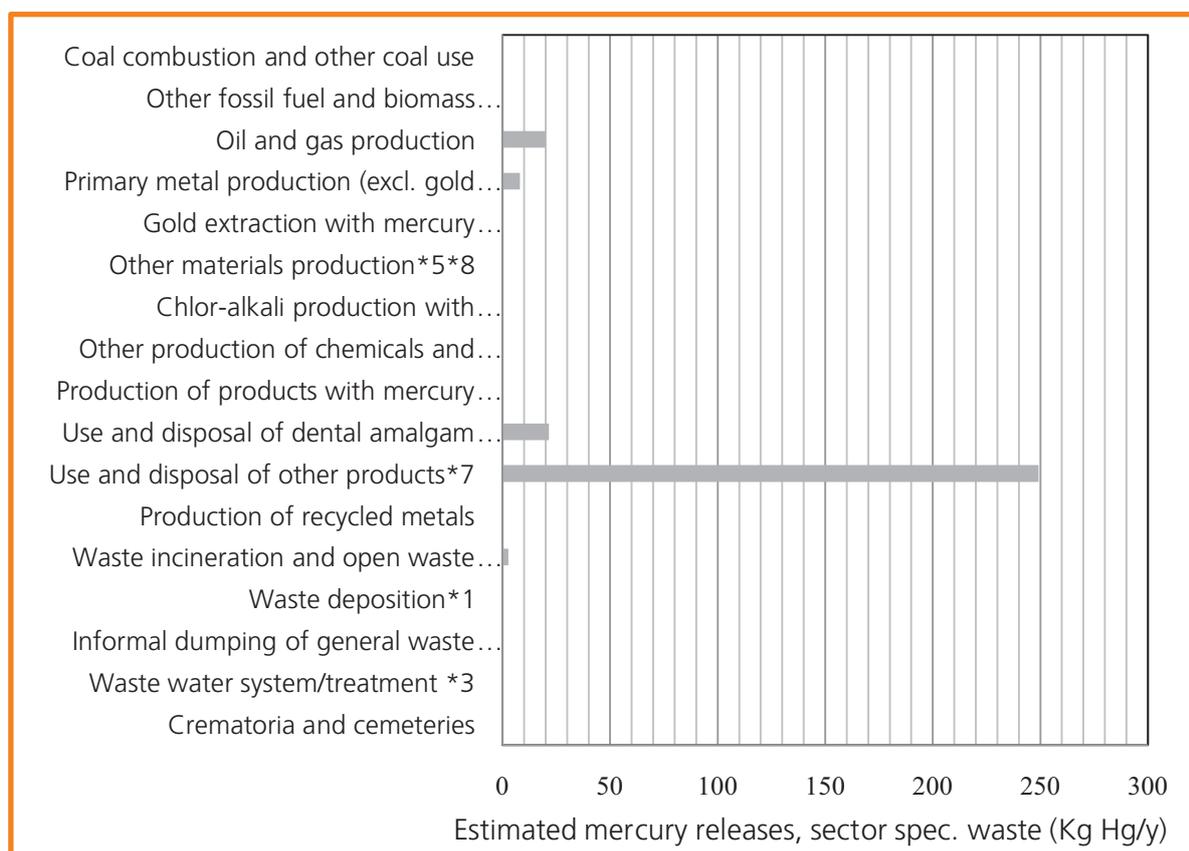


Figure 2.6 Graphical illustration of sources of mercury releases to sector specific waste treatment/disposal

## 2.6 SUMMARY OF MERCURY STOCKPILES, SUPPLY AND TRADE

Ghana does not mine mercury and neither is it produced as a by-product of other metal mining. However, the country imports mercury and mercury-containing products. Artisanal and small-scale gold mining (ASGM), represents about 80% of the total mercury demand in Ghana. The remainder is spread mostly between use in dental amalgam and imported mercury-added products. Under the Mercury Act,

1989, the Minister responsible for Trade may issue a license to a person authorizing that person to import into the Republic, possess, buy, sell or deal in mercury, subject to the conditions specified in the license.

According to the World Bank Country Reports on Mercury Trade and Use for Artisanal and Small-Scale Gold Mining (2016), data on import/exports for Ghana reported by partner countries as captured in the UN Comtrade database are shown in Tables 2.6 and 2.7.



Table 2.6. Import (in kg) of mercury to Ghana by country 2010-2014 (Comtrade database)

Country	2010	2011	2012	2013	2014	2015
Belgium	19,450	7,340		3	-	-
China		652	3,706	44	-	-
Germany		59			-	-
India		1,506	4		-	-
Lebanon				1,122	-	-
Singapore			8,625		-	-
South Africa	35	11,230			-	-
Spain	390	3,712			-	-
UK	72	3			-	-
Total	19,947	24,502	12,335	1,169	nd	Nd

Note:

From tables 2.6 and 2.7, the reported amounts of import and export have decreased significantly since 2010. Until 2011 when the EU export ban went into force, a significant amount of mercury was imported from the EU. India and Singapore registered

significant exports of mercury to Ghana in 2015 (World Bank, 2016). The recorded import is thus well below the estimated consumption of mercury ranging from 49 -91 t/year for ASGM purposes (Global Mercury Assessment), suggesting that mercury may have been covertly imported into Ghana.



Table 2.7 Export of mercury in kg to Ghana by country 2010-2014 (Comtrade database)

Country	2010	2011	2012	2013	2014	2015
Belgium	3,450					
China, Hong Kong SAR		5,175				
Germany		99	9	2		2,505
India	173					
Mexico	17,250	3,450				
The Netherlands		863			518	7,728
Singapore	2,277					
Spain		21				
UK						
Total	23,150	9,608	9	2	518	10,233

Note:

In 2015, exports from Singapore and India accounted for the bulk of official mercury inflows into the country, whereas no import of mercury to the country was reported (COMTRADE Mercury Statistics for Ghana – World Bank, 2016). For this inventory, data on import licenses for the period 2006-2016 were received from the Ministry of Trade and Industry.

A reported 18 shipments – ranging from 5 kg to 20 t in quantity – were requisitioned by 27 licensed companies in the period 2011 to 2016. The variety of importers include chemical suppliers, mining equipment dealers, gold mining companies and general trading enterprises (specialized in wood, agricultural products, etc.). In 2015, the total import by the licensed companies was 0.9 t (World Bank Report, 2016).

Nonetheless, the amount imported does not give realistic reflection of the total mercury imported into Ghana for ASGM. According to EPA, which is the Focal Point for the Minamata Convention in Ghana,

the official declining mercury imports may partly be reflective of smuggling and the pervasive black market in the ASGM sector. Mercury may enter the country unofficially through unapproved entry points.

Approximately 80% of elemental mercury imported is used in ASGM operations to recover gold.

Mercury containing devices are used primarily in educational and research institutions, health care facilities, meteorological services and other allied institutions. The devices are mainly thermometers, manometers, barometers, and sphygmomanometers, as well as analytical equipment. These devices are used for measuring various climatic parameters and patients' vital statistics as well as for scientific and industrial research. In some cases, individuals also procure some of these devices for use in their homes especially the thermometers. Accurate and more comprehensive data on the quantity of mercury containing devices in Ghana are scarce as a result of poor record keeping and reporting. Official imports



of these devices into the country which are accounted for by the Customs Division of GRA do not distinguish between mercury containing and mercury free devices.

UNDP in partnership with the Ministry of Health undertook a pilot project on health care waste management funded by the Global Environment Facility (GEF). Under that project, an inventory of mercury containing devices used in the various health care facilities in Ghana, was conducted in seven health care facilities with different capacities (teaching hospitals, regional hospital, district hospital, health care centre, faith-based facility and a polyclinic). The report indicated that, a high percentage of mercury containing devices (thermometers and sphygmomanometers) have broken down while others were still in use. However, data was lacking as to how they managed to store the broken-down devices and the end-of-life of those equipment. The report further indicated that, mercury containing sphygmomanometers were in a decline because most hospitals and households are now using digital sphygmomanometers, which are more convenient, to monitor their blood pressure. Moreover, the number of mercury containing thermometers used in the health sector has reduced over time due to frequent breakages and time-consuming nature for taking readings from different patients. The digital thermometers are easy to use and readings can be obtained faster and devices can be reused. These have helped in reducing the number of mercury containing thermometers in health facilities in Ghana.

## 2.7 DATA AND INVENTORY ON ENERGY CONSUMPTION AND FUEL PRODUCTION

Ghana represented by Volta River Authority (VRA) in collaboration with Shenzhen Energy Group Co., Ltd. (SEC) intends developing a 2×350 MW supercritical coal-fired power generating facility (including the affiliated coal handling terminal) to be situated along the coastline of Ghana. The project is intended to contribute considerably to addressing the domestic

power generation shortfall in the near future to improve Ghana's future power balance. In reference to this project a scoping report that outlines the conditions of the environment earmarked to accommodate the proposed 2×350MW Supercritical Coal-Fired Power Plant project has been developed and submitted to Ghana EPA to fulfil Environmental Protection Agency Act 1994, Act 490 (Parts 1&II) and Environmental Assessment Regulations 1999, LI 1652. Ghana has however, developed draft Environmental Quality Regulations which include air, noise and effluents quality standards.

### 2.7.1 COMBUSTION/USE OF DIESEL, GASOLINE, KEROSENE, LPG AND OTHER PETROLEUM PRODUCTS.

Ghana's energy sector can be classified into two main categories, petroleum and power. The country's petroleum industry is divided into upstream and downstream sectors. Upstream activities include exploration, production and transportation of crude oil and natural gas. Downstream activities include refining, processing, marketing and distribution of petroleum products by oil marketing companies (OMCs). In recent times, a number of local small- and medium-scale OMCs have been established (Energy Commission, 2014).

The power sector also comprises the hydro, thermal, solar, gas and wind sources. The Ghana Energy Commission Report (2016) indicates that, the petroleum products supplied to the economy (kilotons) by the Ghana National Petroleum Corporation (GNPC) from 2012-2015 is 3,325.10 Kt. Hence, using the average adjacent years (2012-2015), the combustion of diesel, gasoline, and kerosene, LPG and other petroleum products is 3,325,000 MT of oil products combusted/y. The estimated mercury input is 18 kg Hg/y.

Note: To arrive at the figure under the activity rate column, annual averages were calculated from 2012-2015 of the Ghana National Petroleum Corporation (GNPC) Annual Petroleum Information data and used as activity rate input data.



### 2.7.2 USE OF RAW/PRE-CLEANED NATURAL GAS

Raw or pre-cleaned natural gas in Ghana comes from oil wells (Jubilee and TEN), which are typically termed “associated gas”. It is also expected that gas production from the Sankofa and Gye Nyame oil fields would come on stream in 2018. These gases exist separate from oil in the formation (free gas) or dissolved in the crude oil (dissolved gas). The natural gas is processed or purified by separating all of the various hydrocarbons and fluids from the pure natural gas, to produce what is known as 'pipeline quality' dry natural gas.

According to the International Energy Agency (IEA, 2018), the consumption of natural gas in Ghana in 2015 was 49,495 TJ, which converts to 1,267,272,000 Nm<sup>3</sup>/y, applying the Toolkit Unit Conversion Tab. The estimated mercury input is therefore 127 kg Hg/y.

### 2.7.3 BIOMASS FIRED POWER AND HEAT PRODUCTION

The biomass energy industry in Ghana performs two distinct and important functions: energy production and waste disposal. Each has significant environmental implications. Energy production from biomass displaces the production of a like amount of energy from conventional sources. At the same time, the use of biomass fuels in energy facilities avoids the alternative disposal of these materials.

Biomass contributes 39.3 % to Ghana's energy mix. National Energy Statistics 2006 – 2015 revealed that biomass consumed, excluding wood, in 2014 is 2,791,700 tons/y for power supply (Ghana Energy Commission report, 2016).

Additionally, biomass (wood, straw and other bio materials) is used as fuels for residential cooking, etc. For wood, FAO estimated the annual fuel wood consumption to be 44.02 million m<sup>3</sup> per year in 2014 (FAO, 2015), which corresponds to 33.02 million t/y, using FAO's estimated conversion factor of 0.75 t/m<sup>3</sup> for hardwood. The 33.02 million t/y includes wood used for charcoal production. This number was used as activity rate in the calculations.

### 2.7.4 CHARCOAL COMBUSTION

Charcoal production in Ghana, is predominantly an informal activity undertaken by groups of persons using the 'cut-and-burn' system. Such groups can produce an average of 10-15 bags of charcoal in a week, which is then collected by the first layer of middlemen who are responsible for getting the bags to accessible roads. The bags are collected by the second layer middlemen, typically truck drivers who deliver truckloads of charcoal bags to urban areas. The charcoal bags are then bought at bulk rates by wholesalers who are responsible for final retail and distribution in smaller quantities. Ghana has a system of 'maxi-bags' (in the range of 50 kg) and 'mini-bags' (in the range of 25 kg).

The 2010 Population and Housing Census undertaken by the Ghana Statistical Service revealed that 80% of the rural population is dependent on wood fuel as their primary source of fuel (GSS, 2012). Charcoal is the primary source of fuel for more than 50% of the population living in urban areas. The urban population in this case, also includes settlements in semi-urban areas (also referred to as “peri-urban” in several official documents) and slums (GSS, 2008). The Energy Commission reports that charcoal production in Ghana increased from 950,000 t in 2001 to 1,416,000 t in 2012, while the population, according to World Bank data rose from 19.4 million to 25.9 million during the same period.

In the National Energy Statistics 2006-2015, it was estimated that the average total consumption of charcoal was 114,310 kt/y (1,143,100 t dry weight/y) (Ghana Energy Commission, 2014).

However, as the wood fuel number used for biomass above includes wood used for charcoal production, no activity rate was entered for charcoal, to avoid double-counting.

### 2.7.5 OIL EXTRACTION

Currently, Ghana has three oil fields in production. These are (i) Jubilee field where the FPSO (Floating Production, Storage and Offloading) Nkrumah is located, (ii) Tweneboa, Enyenra and Ntomme (TEN)



and (iii) The Sankofa oil and gas fields. In addition to these production fields, there are a number of on-going exploration activities in Ghana.

Ghana earned \$978.87 million equivalent to GHC 3 billion from the export of oil from the Jubilee Field as of 2014. The volume of crude oil produced from the Jubilee Field in 2014 was 37,201,691 barrels representing an increase of 42.6% over 2011 production levels, according to the Ministry of Finance (2015). The average daily production rate in 2014 was 101,922 barrels per day.

oil production from Jubilee and TEN Oil Fields from January to December 2016 was 32,297,780 barrels/y (4,667,310 crude oil produced t/y) as shown in the Table 2.8. Thus, the activity rate for oil extraction from the Jubilee and TEN fields in 2016 is 4,667,310 ton/y of crude oil produced and the estimated mercury input is 16 kgHg/y.

According to the Petroleum Commission (PC), crude

Table 2.8 Crude oil production from Jubilee and TEN fields (January to December 2016)

MONTH	JUBILEE FIELD PRODUCTION (BBLs)	PRODUCTION DAYS	TEN FIELD PRODUCTION (BBLs)	PRODUCTION DAYS	TOTAL CRUDE OIL PRODUCTION (JUBILEE & TEN)
January	3,112,793.00	31	-	-	3,112,793.00
February	2,876,466.00	29	-	-	2,876,466.00
March	1,321,719.00	31	-	-	1,321,719.00
April	-	-	-	-	-
May	1,525,973.00	31	-	-	1,525,973.00
June	2,603,178.00	30	-	-	2,603,178.00
July	2,378,761.00	31	-	-	2,378,761.00
August	3,093,778.00	31	135,778	31	3,230,414.00
September	2,919,429.00	30	950,036	30	3,869,465.00
October	3,029,181.00	31	1,124,324	31	4,153,505.00
November	1,709,832.00	30	1,453,648	30	3,163,480.00
December	2,410,530.00	31	1,652,354	31	4,062,884.00
<b>TOTAL</b>	<b>26,981,640.00</b>	<b>366</b>	<b>5,316,140</b>	<b>153</b>	<b>32,297,780.00</b>
AVERAGE	<b>73,995</b>		<b>34,746</b>		

Source: PC, 2017



### 2.7.6 OIL REFINING

The Tema Oil Refinery (TOR) Limited is Ghana's only refinery established in 1963 to enhance the country's economic, investment and development programmes. Crude oil is used as the refinery's main raw material for production. Though Ghana produces oil, almost all of this local production is exported in crude form. To satisfy local demand, Ghana imports more than 80% of its crude oil (lower grade crude) requirements from Nigeria and transferred through pipelines to the refinery storage tanks for processing into several finished products (gasoline, gas oil, kerosene, premix, fuel oil, and particularly Aviation Turbine Kerosene) for consumption.

The presence of mercury is also confined with crude oil which contains Hg at varying degrees, depending on the origin. On the average, a total of 359,584 t of oil was refined from 2012-2016, according to the National Petroleum Authority (NPA), Annual Petroleum Information data. The estimated mercury input is 1.0 kgHg/y.

### 2.7.7 EXTRACTION AND PROCESSING OF NATURAL GAS

Natural gas is a fossil fuel like coal and crude oil (or petroleum). As mentioned earlier, raw or pre-cleaned natural gas in Ghana comes from oil wells (Jubilee and TEN), which are processed by the Atuabo Gas Processing Plant. The Plant was established in 2014 and is operated by the Ghana National Gas Company (Ghana Gas). The Atuabo plant has the capacity to process more than 180,000 tonnes of liquefied petroleum gas (LPG) for domestic use, representing about 70% of the national requirement of 240,000 t; the delivery of 46,000 t of condensate and about 15,000 t of isopethain.

According to Ghana National Petroleum Corporation, Jubilee and TEN oil and gas fields delivered a total volume of 20,474.8 MMSCF (568,502,528 Nm<sup>3</sup> gas produced/y) of associated natural gas in 2017 to Atuabo Gas Processing Plant for processing to meet pipeline quality and end-users specification (Table 2.9). Thus, the activity rate for extraction and processing of natural gas is 568,502,528Nm<sup>3</sup> gas/y and the estimated mercury input is 57 kgHg/y.

Table 2.9 The total volume of associated natural gas delivered to Atuabo National Gas Processing Plant in 2017

MONTH	DELIVERED VOLUME (MMSCF)	
	Jubilee	TEN
Jan-17	1,570.30	
Feb-17	242.40	
Mar-17	2,299.60	
Apr-17	2,383.30	
May-17	2,048.20	238.40
Jun-17	2,313.50	-
Jul-17	2,685.70	10.30
Aug-17	3,432.70	-
Sep-17	3,240.30	10.00
<b>Total</b>	<b>20,216.10</b>	<b>258.70</b>

Source: GNPC



## Data Gaps and Priorities for Follow Up

The energy sector in Ghana is well regulated by the Ministry of Energy and data readily available except that on mercury. There is a system for data movement from the production to consumption sectors.

## 2.8 DOMESTIC PRODUCTION OF METALS AND RAW MATERIALS

### 2.8.1 PRODUCTION OF LEAD FROM CONCENTRATES

Gravita Ghana Limited and Goldline operate a secondary lead smelter separately at Tema, producing Lead Bullion in Ingots and Polypropylene Chips for export. The records from Gravita Ghana Limited and Goldline showed that 10,800 and 5,111 t of secondary lead was produced annually, respectively. Since the production is from recycled lead but not virgin lead from ore concentrate, it is not considered a significant source of mercury release however, and no activity rate was entered for this activity.

The information source is the Ghana Stockholm Convention National Implementation Plan (2018)

### 2.8.2 GOLD EXTRACTION BY METHODS OTHER THAN MERCURY AMALGAMATION

Ghana is Africa's second-largest gold producing country after South Africa. Gold mining therefore constitutes an essential segment of the Ghanaian economy and has contributed notably to the country's socioeconomic development, dating back to the colonial era. Gold mining occurs entirely in all the regions of the country including Ashanti, Brong-Ahafo, Eastern, Western regions as well as the three regions of the north. Two categories of gold mining can be identified in Ghana. These are large-scale gold mining and artisanal small-scale gold mining (ASGM), both with different ore treatment methods as well as some pockets of illegal artisanal mining popularly known as "galamsey". Large-scale gold

mining involves extraction of gold from the ore by processes that do not involve mercury amalgamation. The processing of the ore for gold involved the crushing and grinding of ore to fine powder followed by dissolution (carbon in leach/pulp and heap leach), precipitation or electro winning and smelting to recover the gold.

According to the US Geological Service 2014 Minerals Year Book for Ghana, Ghana produced a total of 90,754 kg (or 90.75 t/y) of gold in 2014 from industrial scale gold production, a slight increase from previous years. The Ghana Minerals Commission (2017) estimated the total industrial scale gold production at 2.8 and 2.6 million oz in 2014 and 2016 representing 78.4 and 72.8 t/y, respectively. Using the Toolkit unit conversion factor of 0.250 t ore to produce 1 g of gold (4 g/t Au/ore), this yields an estimated activity rate of 19,600,000 t/y gold ore used, associated with a mercury input of 19,600 kg Hg/y. This amount of mercury was arrived based on a change in default input factor (Toolkit IL2) from 15.0 to 1.0 g Hg released/emitted per ton of ore extracted.

According to official communication from Minerals Commission, "mineralization in Ghana has significant iron content (iron oxide or iron sulphide), which helps in the rapid precipitation of gold and sulphur from hydrothermal solutions. The Oxides do not have mercury associated with them". (See Annex 5 for full details). Industry players in the country, however, argued that the level of mercury in gold ore in Ghana is either in trace quantity or quite negligible.

Available information/data from the field suggests mercury concentration of 0.25 g/t within the gold ores, which yields mercury input of 4,900 kg Hg/y. This therefore informed the decision to change default input factor (Toolkit IL2) from 15.0 to 1.0 g Hg released/emitted per ton of ore extracted. The amount of mercury input from the extraction of gold without amalgamation in Ghana is presently unclear given the wide variation of the two scenarios. Thus, specific field data is needed to resolve this aspect of the inventory.



Refer to Figure 2.7 for the contribution of ASGM to the National Economy (large-scale vrs small scale gold production (1990-2014)

### 2.8.3 ALUMINA PRODUCTION FROM BAUXITE (ALUMINUM PRODUCTION)

Ghana is one of the leading countries with huge deposits of bauxite. In 2014, bauxite production was 835,000 t and increased by 9.9 % from 2013 estimates of 827,000 t according to the USGS 2014 Mineral Yearbook for Ghana. Whereas the production of primary aluminum in the country was reported to be 38,000 t. Using the Toolkit unit conversion tab, this equals approximately 161,500 t bauxite processed/y in the country. The estimated mercury input for the alumina production from bauxite is 81 kg Hg/y.

### 2.8.4 PRIMARY FERROUS METAL PRODUCTION (IRON, STEEL PRODUCTION)

Ferrous metal production is thought to be a major mercury emission source because it uses large amounts of coal and iron ore, which contain trace amounts of mercury impurities. However, there is no production of primary ferrous metal (iron and steel production) in Ghana; hence, there are no emissions/releases from this sector in Ghana.

### 2.8.5 GOLD EXTRACTION WITH MERCURY AMALGAMATION - FROM CONCENTRATE

Amalgamation with mercury is the dominant method for gold extraction and the current number of workers directly employed in artisanal gold mining must therefore be between 10 and 15 million worldwide, including 4.5 million women and 600,000 children (Veiga and Baker, 2004).

Amalgamation is the preferred gold recovery method employed by almost all artisanal gold miners in Ghana

because it is a very simple, easy-to-use, technique and available. The Artisanal Gold Council Report in 2016 estimated that 70 t of mercury is used in the artisanal and small-scale gold mining (ASGM) industry in Ghana. The ASGM miners extract gold with mercury from concentrates (amalgamation) and do not practice whole ore amalgamation (UN Environment, 2017a). It is a known fact that small scale artisanal gold mining operations (licensed and unlicensed) occur in 8 out of the 10 regions of Ghana. The Minerals Commission has designated nine mining districts, namely, Tarkwa, Asankragua, Bibiani, Akim Oda, Assin Fosu, Konongo, Obuasi, Bolgatanga and Wa.

It is estimated that small-scale gold mining activities accounted for about 35% of Ghana's total gold output in 2014 (Minerals Commission, 2015). In Ghana, the mercury emissions from ASGM activities are likely to be higher due to low patronage of retorts and limited availability of mercury-free alternatives. Many ASGM miners have consistently complained about the retorts (glass and metal) because of the slower process and the inability to see the gold in the metal retorts (Rajae et al., 2015). Even transparent retorts, such as the ThermEx<sup>®</sup> retort promoted by the Minerals Commission, have been underutilized because of their low capacity and fragility (Hilson et al., 2006). A research survey conducted by Rajae et al. (2015) revealed that, 44 licensed and 77 unlicensed miners in the Denkyira corridor showed only 27% of respondents used a retort while 68 % burned the mercury amalgam over an open flame. The Ghana National Association of Small-Scale Miners (GNASSM) has indicated that only about 30% of the ASGM operators use the retort device in their activities (Personal communication).

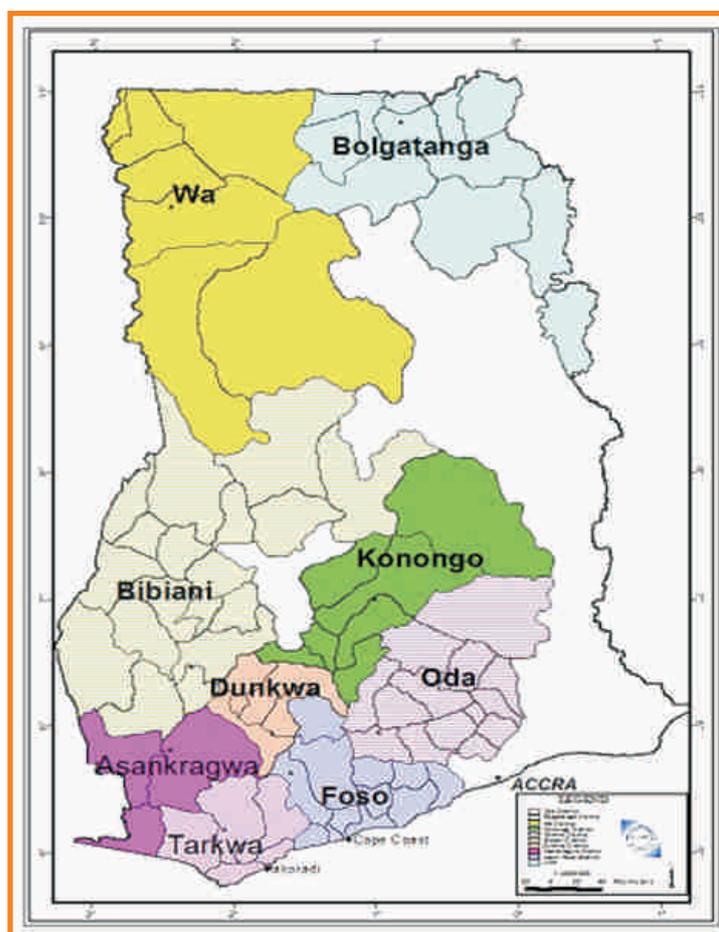


Figure 2.7: Map showing ASGM designated Mining Districts of Ghana

Notes:

According to the USGS 2014 Minerals Year Book for Ghana, Ghana produced a total of 90,754 kg (or 90.754 t) of gold in 2014 from large-scale gold production. The Minerals Commission, which is the Government entity responsible for regulating and managing the use of Ghana's mineral resources and for coordinating Government policy related to them, estimated that gold extraction by methods other than mercury amalgamation activities accounted for about 65 % of Ghana's total gold output (Ghana Chamber of Mines, 2014, p. 8). From these numbers it is

estimated that, gold production using amalgamation of about  $0.35 * 90,754 \text{ kg} / 0.65 = 48,867 \text{ kg}$ .

Gold production from ASGM in 2014 and 2016 were reported as 1.5 and 1.1 million oz respectively (Ghana Minerals Commission Report, 2015 and 2017), corresponding to 42 and 30.8 t of gold, respectively. For 2014, this is a reasonable correspondence with the USGS derived number for ASGM gold production. The development in gold production depicted in Figure 2.8 below.

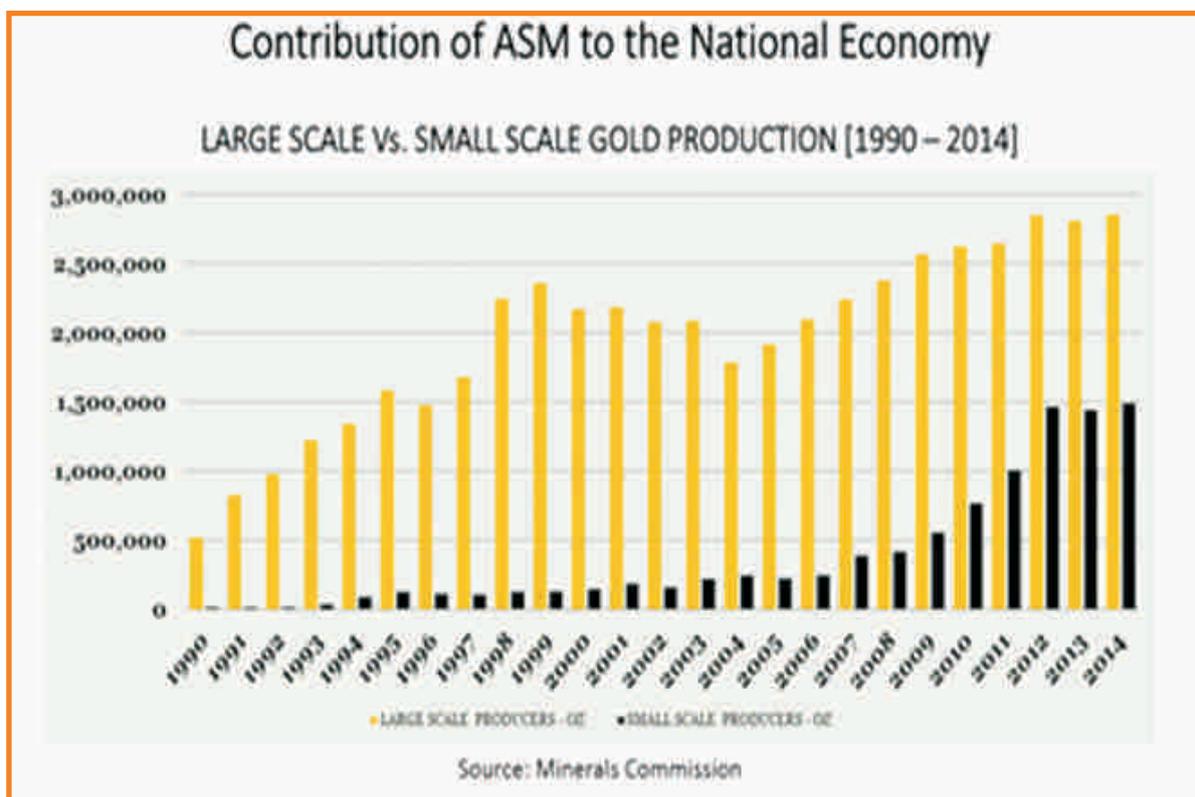


Figure 2.8 Contribution of ASM to the National Economy (large scale vrs small scale gold production (1990-2014) (Ghana Minerals Commission Report, 2015).

Based on the considerations above, the Minerals Commission data for 2014 corresponding to 42,000 kg of gold extraction with mercury amalgamation from concentrate was used in the calculation.

According to preliminary results from the baseline mercury inventory of the Ghana National Action Plan (NAP) on ASGM for the Tarkwa mining District, the mercury to gold ratio was between 1.3 and 1.5 gHg/gAu (Mercury practices and use estimates in Ghana: Tarkwa District, 2017). This value is close to the Toolkit default input factor of 1.3 gHg/gAu. From the above narration, the activity rate per annum of gold extraction with mercury amalgamation from concentrate is 42,000 kg /y with an estimated mercury input of 45,150 kg Hg/y.

#### 2.8.6 GOLD EXTRACTION WITH MERCURY AMALGAMATION - FROM WHOLE ORE

In Ghana gold extraction is from concentrate amalgamation and not from whole ore (UN Environment, 2017a).

#### 2.8.7 CEMENT PRODUCTION

Cement is manufactured through a closely controlled chemical combination of calcium, silicon, aluminum, iron and other ingredients. Common materials used to manufacture cement include limestone, shells, and chalk or marl combined with shale, clay, slate, blast furnace slag, silica sand, and iron ore. Mercury is present in the raw materials (e.g., limestone) and/or in the fuel (e.g. coal) released in the combustion process. The major pathway for mercury releases from the cement industry is via emissions to the atmosphere. Cement industry contributes an estimated 10 % or about 190 metric tons of the



estimated total of 1921 metric tons per year of global anthropogenic mercury emissions. Emerging markets of the world will lead to an unprecedented rate of construction, of new cement plants resulting in further emissions of mercury.

Ghana currently has four domestic cement producers namely, West African Cement, SA (Diamond Cement Ghana Limited, Savanna Cement Company limited and Western Diamond Cement Company Limited located in the Aflao, Buipe and Takoradi, respectively), Ghana Cement Company (located in Tema and Takoradi), Dangote Cement Company (located in Takoradi and import facility in Tema) and CimENTS de L'Afrique Ghana Limited (CIMAF) Company located in the Tema Free Zones enclave.

Of these, only the Savanna Diamond Company, which mines limestone locally from Northern region (Buipe), produces its clinker in Ghana. The remaining companies import clinker.

Because Savanna Diamond Company limited produces its own clinker, using pulverised coal as a fuel, the current total production capacity (activity rate per annum) for the year 2016 was used in the calculation of the estimated mercury input. Thus, the activity rate per annum for Savanna Company Limited is 350,000 t/y in 2016 estimated mercury input 41 kgHg/y.

Table 2.10: Distribution of activity rates on the relevant mercury controls, according to Savanna Company Limited (Personal Communication from Savannah 2017)

NO/LOW WASTE use as fuel; relevant pollution abatement options	No filter	Simple particle control (ESP / PS / FF)	Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)	Efficient air pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)	Very efficient pollution control (wetFGD+ACI / FF+scrubber+SNCR)	Hg control /
Enter per cent of total activity rate per type:	0			100		



### 2.8.8 PULP AND PAPER PRODUCTION

Pulp is made predominately from wood, but in many cases, it is made from other plant fibers such as cotton, linen, and hemp and grasses such as straw, wheat, and kenaf. There is no available data indicating pulp and paper production in Ghana, however, imported pulp of wood or of other fibrous cellulosic materials in Ghana amounted to GH¢ 2,027,300 in 2015 (GSS, 2016). Hence no activity rate was therefore identified in this sector.

### 2.8.9 DATA GAPS AND PRIORITIES FOR FOLLOW UP

The data for metal and raw materials production, including gold extraction by methods with mercury amalgamation and without mercury amalgamation from concentrate; cement production, are regulated and there is a system for data movement from the producers to responsible departments such as Minerals Commission, Precious Minerals and Marketing Company (PMMC), Ministry of Trade and Industry, Ghana Revenue Authority (GRA) etc. Hence no data gap was identified in this section.

## 2.9 DOMESTIC PRODUCTION AND PROCESSING WITH INTENTIONAL MERCURY USE

As indicated in the inventory results in Table 2.1 the following activities are not practiced in Ghana's production and processing sectors. There was therefore no evidence of mercury releases from these areas. They are as follows;

- Chlor-alkali production with mercury-cells
- VCM production with mercury catalyst
- Acetaldehyde production with mercury catalyst
- Mercury (Hg) thermometers (medical, air, laboratory, industrial etc.)
- Electrical switches and relays with mercury
- Light sources with mercury (fluorescent,

compact, others: see guideline)

- Batteries with mercury
- Manometers and gauges with mercury
- Biocides and pesticides with mercury

### 2.9.1 PAINTS WITH MERCURY

There are a lot of locally produced and imported paints in Ghana. It is however uncertain if any of these paints contain mercury. Thus, no activity was confirmed in this sector. This could be a priority for future inventories.

### 2.9.2 SKIN LIGHTENING CREAMS AND SOAPS WITH MERCURY CHEMICALS

There are a lot of locally produced and imported cosmetics used for skin lightening in Ghana. Most of the imported soaps and creams contain trace levels of mercury which were well below the US Food and Drugs Administration acceptable limits of 1.0 µg/g (Agorku et al., 2016). Comprehensive studies in local and imported cosmetics are needed and this could be a priority for future inventories.

### 2.9.3 Data Gaps and Priorities for Follow Up

No activity was confirmed as regards production of mercury-containing paints and cosmetics. As both of these product types may have substantial mercury concentrations, this could be a priority for future inventories.

## 2.10 WASTE HANDLING AND RECYCLING QUESTION ABOUT GENERAL WASTE MANAGEMENT SETUP

This question was demanded by the Toolkit and the answers to the question was used to determine factors that the toolkit uses to estimate mercury emissions and releases in waste handling and recycling. Hence, Table 2.11 below addresses information on general waste management set up in Ghana.



Table 2.11: The overall questions about the overall waste treatment setup in the country were answered as follows:

Please answer questions about the current waste treatment set-up in your country:	Y/N			Y/N
a) Is more than 2/3 (two thirds = 67%) of the general waste collected and deposited on lined landfills or incinerated in closed incinerators?	N		b) Is more than 1/3 (one third = 33%) of the mercury-added products waste safely collected and treated separately?	N

#### 2.10.1 PRODUCTION OF RECYCLED MERCURY (SECONDARY PRODUCTION)

This activity is not practiced in Ghana.

#### 2.10.2 PRODUCTION OF RECYCLED FERROUS METALS (IRON AND STEEL)

The estimated number of vehicles reaching end-of-life in a specific year is the activity rate in the Toolkit's mercury inventory methodology for recycling of ferrous metal. This is because some old cars may still have mercury-containing switches. The estimated average life span of 30 years for life expectancy of vehicles in Ghana was considered. There is approximately a total average of 36,823 new and used vehicles imported into the country annually (Ghana Stockholm Convention National Implementation Plan, 2018)). Therefore, for this inventory it is estimated that approximately the same number has subsequently gone through recycle processes to produce iron and steel products according to the Driver and Vehicle Licensing Authority (DVLA, 2015).

#### 2.10.3 INCINERATION OF MUNICIPAL/GENERAL WASTE

Waste combustion or incineration is basically a controlled burning process. In Ghana the large unplanned dumps of refuse are essentially mixtures

of combustible refuse such as paper, cardboard, vegetable matter, cartons, wood boxes and combustible floor or ground sweepings containing approximately 15% moisture and incombustible solids and others (10 % of oily rags).

There are few incineration facilities in this sector. It is however uncertain if any of these facilities are used for the incineration of municipal or general waste. There is no data or unavailability in this sector. The waste that may flow to this activity have instead been allocated under the other waste sub-categories.

#### 2.10.4 INCINERATION OF HAZARDOUS WASTE

The management of hazardous wastes generation is a challenge in countries with limited waste treatment infrastructure and Ghana is no exception. In the development of the Ghana National Implementation Plan for Stockholm Convention (NIP, 2018), an inventory was conducted to identify operational facilities for incinerating hazardous waste. In the assessment, companies within the country operating incinerators for hazardous waste were visited and data for annual tonnages of hazardous waste that are incinerated were obtained. It was found out that a total of 1,120 t of hazardous waste are incinerated per year. Using this figure, the activity rate per annum for incineration of hazardous waste is 1,120 t/y and estimated mercury input 27 kgHg/y.



#### 2.10.5 INCINERATION OF MEDICAL WASTE

Biomedical waste is waste generated from biological and medical sources including medical laboratories, hospitals and clinics. This classification of waste includes discarded blood, tissue from surgery or birth, gloves, used bandages, and sharps such as syringes, needles, and blades. During the inventory of Ghana National Implementation Plan for Stockholm Convention (NIP, 2018), to identify Unintentional Release of POPs, hospitals within the country using incinerators were assessed and it was found out that, a total of 844 t of medical waste are incinerated per year. Using this figure, the activity rate per annum for incineration of medical waste is 844 t/y and estimated mercury input 20 kgHg/y.

#### 2.10.6 SEWAGE SLUDGE INCINERATION

Sewage sludge incineration is not practiced in Ghana.

#### 2.10.7 OPEN FIRE WASTE BURNING (ON LANDFILLS AND INFORMALLY)

The per capita generation of solid waste in Ghana is estimated as 0.47 kg/day (Miezah et al. 2014). Based on the population of 27 million, total solid waste generated per day is  $0.47 \times 27 \text{ million kg} = 12,690,000 \text{ kg}$  of waste which is equivalent to 12,690 t/day, which converts to 4,632,000 t/y.

Open fire waste burning is a common practice in Ghana. According to Ghana Living Standards Survey 5 (GLSS 5), the fraction of waste subjected to open fire burning is 80 %. Data obtained from some local waste managers within the Metropolitan, Municipal and District Assembly's (MMDA's) Waste Management Department estimated that about 15 % of waste are subjected to open burning (Personal communication, 2017).

Moreover, a survey conducted by Addaney and Oppong (2015) at the Kasoa Municipal Assembly revealed that, 19 % and 23.3 % of domestic and non-domestic waste respectively were disposed of through open burning outside of landfills.

It is the opinion of the Inventory Team that whilst the information obtained from the GLSS may have been over-estimated, the personal communication from waste managers within the MMDAs may also have been underestimated. Based on other considerations, the expert team therefore suggests a realistic estimate of about 40 % of the total amount of waste generated being burnt openly both inside and outside landfill sites. Thus, the activity rate for the waste subjected to open burning is  $0.4 \times 4,632,000 \text{ t/y} = 1,852,800 \text{ t/y}$ . The estimated mercury input is 9,264 kgHg/y.





#### 2.10.8 CONTROLLED LANDFILLS/DEPOSITS

Controlled landfills/deposits, which is often described as the most feasible option of waste disposal due to its costs and environmental impact, has been widely advocated in developing countries such as Ghana (Owusu et al. 2015). More recently, cities such as Kumasi, Sekondi-Takoradi and Accra have constructed engineered landfills. Nonetheless, the capacities of these landfills are very small relative to the quantity of wastes generated daily in these cities. According to the Waste Management Department of the Accra Metropolitan Assembly, waste which was landfilled in 2017 was 144,766 t/y.

However, in the opinion of the inventory team and other considerations, a realistic estimate of about 15% of the total amount of waste generated was suggested to have been deposited at controlled

landfilled site. Thus, the activity rate for the waste deposited at controlled landfilled site is  $0.15 * 4,632,000 \text{ t/y} = 694,800$ . The estimated mercury input is 3,474 kgHg/y.

#### 2.10.9 INFORMAL DUMPING OF GENERAL WASTE

Informal dumping of general waste often results from irregular and unreliable municipal waste collection programmes, and citizens may resort to informal dumping to remove waste from their homes. It is estimated that, a total of waste subjected to informal dumping is 4,632,000 (total waste generation in Ghana)-1,852,800 (waste subjected to open burning)-694,800 (waste deposited at controlled landfills) = 2,084,400 t/y. The estimated mercury input is 10,422 kgHg/y.



There are many uncontrolled open dumpsites for general waste across the country.



## 2.10.10 WASTE WATER SYSTEM/TREATMENT

Ghana has a very low coverage for wastewater and faecal sludge treatment which is mostly sewerage systems. The national average for sewerage coverage is as low as 4.5 % (Civil Engineering Department of KNUST, 2016). There are quite a few wastewater treatment plants in various MMDAs and a number of satellite sewerage systems in some towns or cities in Accra. However, Tema is the only municipality with a comprehensive sewerage system. Nonetheless, treatment facilities for most of the systems have either broken down and not in use or are facing technical challenges. James Town wastewater treatment plant did not yield any data because the plant had not been operational for about a year. This is because the main pumping station suffered a mechanical failure and thus no data was available for the assessment of waste water system for the inventory.

However, this sub-category covers additional waste streams made up of amalgam from dental clinics and effluent discharges from other industrial processes that involve mercury.

The value of wastewater flow used for sewer design is the daily peak flow. This can be estimated as follows:

$$q = k_1 k_2 wp / 86400$$

where q = daily flow rate

k<sub>1</sub> = peak factor (= daily peak flow divided by average daily flow)

k<sub>2</sub> = return flow (= wastewater flow divided by water consumption)

w = average water consumption (litres per person per day)

p = population served by sewer

k<sub>1</sub> and k<sub>2</sub> were assumed to be 1.8 and 0.8, respectively (Agodzo and Huibers, 2014)

was assumed to be 90 L/person/day (Agodzo and Huibers, 2014)

Urban population in Ghana in 2016 = 15,055,103 (<http://www.worldometers.info/world-population/ghana-population/>)

$$\begin{aligned} q &= (1.8 \times 0.8 \times 90 \times 15,055,103) / 86400 \\ &= 22,582.65 \text{ l/s} \\ &= 1,951,140.96 \text{ m}^3/\text{day} \\ &= 712,166,450.4 \text{ m}^3/\text{year} \\ &= 712 \text{ million m}^3/\text{year} \end{aligned}$$

Based on this, approximately 712,000,000 m<sup>3</sup> of water was supplied in urban areas in Ghana, Thus the activity rate for wastewater system/treatment is 712,000,000 m<sup>3</sup> and the estimated mercury input is 3738 kgHg/y. This may be an over estimation as a Toolkit default input factor is based on data from developed countries only.

## 2.10.11 PRIORITIES FOR POTENTIAL FOLLOW UP

A number of data gaps were identified in this area of waste handling due to the large numbers of players in waste processing and handling. Regulations should be introduced requiring all players in waste handling and processing to supply information on the volumes and quantities of wastes they are handling on monthly basis to authorities such as the various Metropolitan, Municipal and District Assemblies (MMDAs) and/or any designated authority.

The assessment for the wastewater treatments systems in Ghana revealed that most of the existing wastewater/faecal sludge treatment facilities are in a poor state and there is the need to pay attention to operations and maintenance of waste water and faecal treatment plants in Ghana. Moreover, most of our waste deposition sites, including the landfill or formal dumpsites, as well as small waste handling facilities, should have weighing equipment for wastes brought to the sites by their clients. It is necessary that all major registered sites demarcated as landfill site, as well as waste handling facility, should have a weighing bridge if the amount of waste produced in Ghana going to formal dumpsites, is to be determined with better approximation. This may improve possibilities for waste management planning.



## 2.11 GENERAL CONSUMPTION OF MERCURY IN PRODUCTS, AS METAL MERCURY AND AS MERCURY CONTAINING SUBSTANCES

### General background data

Background calculations for the product groups listed below were based on the data on population, electrification rate and dental personnel density shown in Table 2.12.

Table 2.12 Background data for default calculations for dental amalgam and certain other product types.

BACKGROUND DATA NEEDED FOR DEFAULT CALCULATIONS AND RANGE TEST			
Compulsory: Click cell below and select country from list	Population in 2010 (or as recent as available data allow; UNSD, 2012)	Dental personnel per 1000 inhabitants	Electrification rate, % of population with access to electricity
Ghana	24,223,431	0.018	61

### 2.11.1 THERMOMETERS WITH MERCURY

The most common mercury containing device used in Ghana is the clinical thermometer. Mercury is used because it is the only liquid metal at room temperature and since all metals expand with heat, when placed in a calibrated glass container, it can accurately measure the temperature. There is no production of mercury thermometers in Ghana. All

thermometers are imported (See Table 2.14). According to UN Comtrade data on the importation of thermometers in Ghana, it is estimated that about 850,750 items of thermometers are sold/y. Hence the activity rate is 850,750 items sold/y, and estimated mercury input is 851 kg Hg/y (United Nations Comtrade database, Assessed on September 12, 2017).



Table 2.13 UN Comtrade data on net imports and average net imports of thermometers

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Netweight (kg)	Qty Unit	Qty, kg derived	Net Imports, Kg derived
2012	Import	Ghana	World	902511	\$79,482	3,168	No Quantity	792,000	792000
2013	Import	Ghana	World	902511	\$65,092	2,738	No Quantity	684,500	
2013	Export	Ghana	World	902511	\$33,445	211	No Quantity	52,750	631750
2016	Import	Ghana	World	902511	\$57,189	4,514	No Quantity	1,128,500	1128500
Total Net Imports Thermometers									2552250
Avg Net Imports Thermometers									850750



### 2.11.2 ELECTRICAL SWITCHES AND RELAYS

Switches are devices that open or close an electrical circuit, or a liquid or gas valve. Mercury-added switches include: float switches, actuated by a change in liquid levels; other tilt switches, actuated by a change in the switch position; pressure switches, actuated by a change in pressure; and temperature switches and flame sensors, actuated by a change in temperature. Relays on the other hand are products or devices that open or close electrical contacts to control the operation of other devices in the same or another electrical circuit. Mercury-added relays include: mercury displacement relays, mercury wetted reed relays, and mercury contact relays.

Due to uncertainty in the distribution of mercury switches and relays in Ghana, the inventory used the default method specified in the Hg Inventory Toolkit, which assumed 0.14 g mercury per inhabitant for this source category, adjusted for technical development with the electrification rate of the country (estimated at 61%). Using this method provided, the highest input of mercury was 2052 kg per year, perhaps indicating a degree of over estimation. The majority of this mercury would be released to general waste treatment

### 2.11.3 LIGHT SOURCES WITH MERCURY-FLUORESCENT TUBES (DOUBLE END) AND COMPACT FLUORESCENT LAMP (CFL SINGLE END)

The most typical light source using mercury is fluorescent lamps. Mercury is present in both the phosphor powder and in the vapour. The same technology can be found in compact fluorescent light (CFL) and other energy efficient bulbs (not LED). There is no production facility in Ghana for light sources. All lights are imported from overseas.

According to Comtrade statistics, the average net import of discharged lamps, fluorescent hot cathode in the period 2009-2013 was 9,671,244 items/yr. We assume that these lamps were distributed 50:50 % on linear fluorescent lamps and compact fluorescent

lamps. In addition, Comtrade reports a net import of 18,735 kg (equaling 374,692 items/yr using the Toolkit unit conversion tab) "other discharge lamps", which we have assumed were compact fluorescent lamps.

Based on this, the activity rate for fluorescent tubes (double end) and Compact fluorescent lamp (CFL single end) were 4,835,621.8 and 5,210,313.8 items/yr respectively. The mercury input for the use of fluorescent tubes (double end) and Compact fluorescent lamp (CFL single end) were 121 and 52 kg Hg/yr respectively.

### 2.11.4 OTHER Hg CONTAINING LIGHT SOURCES

Mercury is used in a variety of light bulbs. Mercury is useful in lighting because it contributes to the bulbs' efficient operation and life expectancy. Mercury-added bulbs are generally more energy efficient and last longer than incandescent and other equivalent forms of lighting. The activity rate per annum of other mercury containing light sources is, based on Comtrade data, 203,658 items sold/yr and the estimated mercury input is 5 kgHg/yr.

### 2.11.5 BATTERIES WITH MERCURY

A variety of button-cell batteries contain mercury. These include zinc air, silver oxide, and alkaline manganese oxide batteries. There is no production of batteries in Ghana. All battery products are imported from overseas.

The net import of batteries according to the Comtrade database (2018) is shown in table 2.141 below. Data for 2014 and 2015 were missing for all products, and we assumed that this is due to lack of reporting for these years. For mercuric oxide batteries, air-zinc and silver oxide batteries, the activity rate used are the average net imports shown in the table. The table also shows manganese oxide batteries (including alkaline batteries) but we have no information whether mercury is present in these batteries.



Table 2.14: Comtrade database showing button-cell batteries that contain mercury

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Netweight (kg)	Qty Unit	Qty	Net Import Weight(kg)
2012	Import	Ghana	World	850630	\$36,817	37,932	No Quantity	0	37,932
2013	Import	Ghana	World	850630	\$125,888	4,277	No Quantity	0	4,277
2016	Import	Ghana	World	850630	\$35,284	29,500	No Quantity	0	29,500
Total Net Import Weight Mercury Oxide Cells									71709
Avg Net Imports Weight Mercury Oxide Cells									23903

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Netweight (kg)	Qty Unit	Qty	Net Import Weight(kg)
2012	Import	Ghana	World	850660	\$1,265	44	No Quantity	0	44
2013	Import	Ghana	World	850660	\$3,692	148	No Quantity	0	148
2016	Import	Ghana	World	850660	\$5,900	820	No Quantity	0	820
Total Net Import Weight Air-Zinc Cells									1012
Avg Net Imports Weight Air-Zinc Cells									337



Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Netweight (kg)	Qty Unit	Qty	Net Import Weight(kg)
2012	Import	Ghana	World	850640	\$1,346	164	Number of items	5,679	164
2013	Import	Ghana	World	850640	\$559	178	Number of items	1,825	178
2016	Import	Ghana	World	850640	\$5,211	4,654	Number of items	21,512	4,654
Total Net Import Weight Silver Oxide Cells									4996
Avg Net Imports Weight Silver Oxide Cells									1665

Period	Trade Flow	Reporter	Partner	Commodity Code	Trade Value (US\$)	Netweight (kg)	Qty Unit	Qty	Net Import Weight(kg)
2012	Import	Ghana	World	850610	\$10,493,296	22,462,832	Number of items	39,606,744	
2012	Export	Ghana	World	850610	\$4,739	263	Number of items	13,225	22,462,569
2013	Import	Ghana	World	850610	\$10,758,906	22,278,665	Number of items	31,901,635	
2013	Export	Ghana	World	850610	\$48,023	138,665	No Quantity	0	22,140,000
2016	Import	Ghana	World	850610	\$6,000,485	15,055,788	Number of items	22,660,021	
2016	Export	Ghana	World	850610	\$1,867	7,041	No Quantity	0	
2016	Re-Import	Ghana	World	850610	\$9	22.5896	Number of items	34	15,048,770
Total Net Import Weight Manganese Dioxide									59,651,339
Avg Net Imports Weight Manganese Dioxide									19,883,780



#### 2.11.6 PAINTS WITH MERCURY

In Ghana, there are several paint manufacturing companies and there is also a large influx of imported paint on the Ghanaian market. Although there is a vibrant paint trade in Ghana, it is generally the case that mercury is not listed on the ingredients list.

It is known that phenyl mercuric acetate (PMA) and similar mercury compounds were used as water-based paint additives. These additives are biocides that work to extend shelf life by controlling bacterial fermentation in the container, as well as to retard fungal growth on painted surfaces under damp conditions. An interview with the major players in the paint industries including Azar Paint, Sikkens Ghana, Coral Paint Ghana, Suvinil Paint, Ezzy Paints, Nonfire Africa limited etc, attested to non-use of mercury in their products. However, a much closer investigation and perhaps sampling and chemical analysis of imported paints could be a priority for future inventories.

#### 2.11.7 COSMETICS WITH MERCURY

Mercury has been used as an active ingredient in skin lightening soaps and creams in relatively high concentrations. It is also found in other cosmetics, such as eye makeup, cleansing products, and mascara, but often in lower concentrations as preservatives. An assortment of cosmetic products including soaps and creams for skin lightening is available on the Ghanaian markets. These products do not have ingredients labels except a description of them as skin lightening creams and soaps.

It is, therefore, possible that there may be skin-lightening products that may contain mercury as part of the ingredient. There is a need to strengthen the monitoring and enforcement of existing regulations. There is a need for comprehensive investigations on the chemical compositions of the skin lightening cosmetic products.



Skin lightening creams are available in most cosmetic outlets in Ghana



#### 2.11.8 POLYURETHANE WITH MERCURY CATALYSTS

Polyurethane (PUR) is a polymer that may be produced with the addition of mercury compounds as catalysts (they however remain in the material). Mercury compounds have especially been used in some PUR elastomers such as shoe soles, conveyer belts and others. PUR is widely used in many applications. In Ghana, there are three main Polyurethane foam industries, namely, Ash Foam Ghana Limited, Latex Foam and Nsawam Foam. There are also other imported PU additives and PUR chemicals (polyol and TDI) to maximize the potential of the industries. These major companies produce foam products. To calculate the proportion of PUR products in use within the country, the Toolkit uses population and electrification rates in combination with a default input factor. For Ghana, the electrification rate used was 61%. PUR with mercury catalyst source contributed 440 kg Hg per year and most Hg is released to the general waste treatment category.

#### 2.11.9 DENTAL MERCURY AMALGAM FILLINGS

For nearly 200 years, silver or amalgam fillings have been used as dental restorative materials. The first mercury-based amalgam was invented by an English chemist in 1819. The content of these fillings changed over the course of time—mercury, silver, tin, copper and gold were all metals commonly used—but these remained the only materials available for tooth repair. There is no production of pre-weighted encapsulated dental mercury amalgams in the country, however as defined by the Toolkit, “production” in this context means in situ preparation at the dentists' clinic.

In Ghana, there are five tertiary institutions offering dental courses. The School includes Kwame Nkrumah University of Science and Technology, University of Ghana, University of Cape Coast, University of Development Studies and University of Allied Health Sciences. However, certain basic pre-dental education courses must be completed before

enrolment in dental school. According to Ghana Dental Association, in 2009 there were only 148 dentists in Ghana. A revised draft Policy for Health Care Waste Management in Ghana which specifically addresses Provisions in Article 4 of the Minamata Convention which set a phase-out date of 2020 for the manufacture, import and export of mercury thermometers and sphygmomanometers as well as reemphasizes on the measures that should also be taken to phase down the use of dental amalgam was explicitly addressed in the policy.

Dental amalgam is cheap and people, especially those in the developing world prefer its use although according to the World Health Organization (WHO), the mercury in dental amalgam was the greatest source of mercury vapour in non-industrialized settings, exposing patients to mercury levels significantly exceeding those set for food and air. There is therefore a greater call for research and legislation into the proper use and disposal of dental amalgam fillings as well as an alternative to dental amalgam in Ghana.

Nonetheless, checks from Ghana Medical and Dental Council revealed that, majority of middle level Ghanaians who normally repair decaying teeth and fill a cavity are unaware about dangers posed by mercury amalgam fillings. Not until recently, however, did a viable alternative become available. Currently, there are mercury-free alternatives available such as tooth-coloured fillings.

As the name implies, tooth-coloured fillings blend in with the natural color of one's teeth. They are made of composite resin materials; which dentist can select and mix to perfectly match one's tooth color. The composite resin used to make tooth-colored fillings is a medical-grade plastic which is considered to be strong and can withstand the pressures of normal chewing and biting. In fact, a tooth-colored filling will actually bond with the remaining tooth structure. Thus, the pressure on your tooth when you eat is evenly distributed throughout the tooth so there is less risk of cracks or leakage, which were always a possibility with amalgam fillings that were only held in place by pressure.



To calculate the proportion of dental amalgam fillings in the country, the Toolkit used dental personnel of 0.018 per 1000 inhabitants and the population in combination with a default input factor. Dental mercury amalgam fillings source contributed 107 kg Hg per year and its greatest contribution is released to water.

#### 2.11.10 MANOMETERS AND GAUGES WITH MERCURY

Mercury is used in manometers and gauges to measure pressure. The blood pressure monitors, also known as sphygmomanometers there are no data available. Work is in progress of what type of mercury added products are used in the health sector but there are no quantitative data available so far. In Ghana, manometers and gauges are all imported. Mercury based thermometers and sphygmomanometers are still widely used in the various medical facilities in Ghana.

Other manometers and gauges with mercury may be used in industry, etc, and for these, the calculations were based on country population in combination with the electrification rate (as a development measure) and a default input factor. The results show a total of 73 kg of Hg per year, with the primary outputs to water and general waste.

A revised draft Policy for Health Care Waste Management in Ghana which specifically addresses Provisions in Article 4 of the Minamata Convention which set a phase-out date of 2020 for the manufacture, import and export of mercury thermometers and sphygmomanometers as well as reemphasizes on the measures that should also be taken to phase down the use of dental amalgam was explicitly addressed in the policy

#### 2.11.11 LABORATORY CHEMICALS

In Ghana, mercuric compounds and reagents are used in demonstration or educational and regulatory laboratories. In view of the limited available data, estimates were made based on population. The

results show a total of 147 kg of Hg per year, with the primary outputs to water and general waste.

#### 2.11.12 OTHER EQUIPMENT AND MEDICAL LABORATORIES WITH MERCURY

Mercury-containing equipment or instruments have been widely used as medical and analytical equipment (i.e. thermometers, Atomic absorption spectrophotometers, sphygmomanometers etc.) in the various educational institutions, private, industrial and regulatory laboratories. In view of the limited available data, estimates were made based on population. The toolkit presented an additional calculation for "other laboratory equipment", which consisted of a list of mercury containing chemicals. The results show a total of 586 kg of Hg per year, with the primary outputs to water and general waste.

#### 2.11.13 DATA GAPS AND PRIORITIES FOR FOLLOW UP

Generally, there is paucity of data on mercury and mercury containing products in Ghana. Some skin lightening cosmetics found on the informal markets have not been registered by Food and Drugs Authority (FDA) and therefore no official data is available. There is an urgent need to come up with strategies to deal with the illicit trafficking of banned cosmetics and unregistered locally produced cosmetics on Ghanaian markets.

Mercury is widely used in research and some analytical equipment due to its unique properties. There is a need to develop a chain of custody procedures for proper handling, collection and disposal of stockpiles of mercury in research institutions, dental clinics and hospitals and the waste produced thereafter.

Ghana does not routinely report her trade statistics to UN Statistics Division (UNSD). The Comtrade data may therefore be considered to provide a low or high-end approximation of the global trade in elemental mercury containing thermometers.



More standardized, comprehensive and timely reporting of international (and domestic, to the extent possible) trades would improve the quality and value of future assessments. The Comtrade data on trade in elemental mercury between individual countries may be further analyzed to show commercial transactions between different regions of the world and their evolution in recent years. This analysis may especially be valuable to authorities involved in regional policy deliberations. Additionally, there is a need for sampling and chemicals analysis of a number of product types.

## 2.12 CREMATORIA AND CEMETERIES

### 2.12.1 CREMATORIA

Cremation is that method of disposal of the dead by rapid combustion of the corpse to ashes. The whole corpse thereafter is reduced to about 0.002268 t of inorganic ash that may be subsequently buried, stored in urns, kept in the house or disposed of in other ways.

There is only one public crematorium in the country situated in Osu and one private and most modern crematorium (gas/electric pyre) located in Lashibi, all in Greater Accra region of Ghana. According to the Crematoria Association of Ghana, there were 44 cremations from 2012 to 2016, therefore, a value of 9 representing total average of dead bodies cremated per year. Therefore, a value of 9 was used as the activity rate for cremations. The calculated mercury input is 0.0225 kgHg/y.

### 2.12.2 CEMETERIES

A cemetery can be described as a large burial ground. In many settlements in Ghana, cemeteries belong to religious groups. There are also public cemeteries for those who do not belong to any religious denomination.

Data was collected from Births and Deaths Registry (Statistical Unit) of the Ministry of Local Government

and Rural Development of Ghana. The national data on deaths (minus data for cremations) for 2016 was used and the number of deaths (minus data for cremations) recorded was 180,000. Therefore, an activity rate of 180,000 corpses buried per year was used to calculate the mercury input per year. The calculated mercury input is 450 kgHg/y.

### 2.12.3 DATA GAPS AND PRIORITIES FOR FOLLOW UP

In Ghana, cremations are mainly based on ethnicity and religious background. Cremation in general is not common among Ghanaians due to cultural and traditional values. As of now, the Births and Deaths Department under the Ministry of Local Government and Rural Development which issues Birth and Deaths certificates does not request information from relatives who register deceased the way the body is going to be disposed. It is recommended that the Births and Deaths Department should start collecting data on the forms of body disposal as this will enable Ghana Statistical Service to get information on cremations. Hence, the mercury releases from cremation activities will remain inaccurate until such data is collected by Births and Deaths Department.

## 2.13 POTENTIAL HOTSPOTS AND CONTAMINATED SITES

Findings from this study showed that mercury manufacturing /processing does not take place in Ghana. Most of the mercury releases were from anthropogenic sources which include the following;

- Gold mining sites, including ASGM- and historical mining sites
- Secondary lead smelter contaminated sites
- Bauxite mining, processing, shipment and alumina smelting sites
- Waste dumping sites particularly where e-waste, cars, ferrous metals etc. are scraped or recycled
- Stocks or storage sites of mercury contaminated equipment including thermometers, medical blood pressure



- gauges (mercury sphygmomanometers), manometers and gauges with mercury etc.
- Sites where “retired” hospital/laboratory equipment containing mercury is stored or dumped.

## 2.14 IMPLICATIONS OF THE INVENTORY RESULTS FOR GHANA AS A PARTY TO THE MINAMATA CONVENTION

It is clear from the results of the inventory set out above that Ghana, in becoming a Party to the Minamata Convention, will need to consider actions to meet its obligations under a number of the articles of that treaty.

With regard to Article 3, Mercury supply sources and trade, while there is no primary mining of mercury and none currently planned, Ghana may need to amend mining regulations to prohibit such mining. While the inventory has not identified either stocks of mercury or industries likely to hold significant stocks, it may be necessary to consider how mercury is being traded for ASGM. It will also be necessary to ensure that any imports and exports of mercury are conducted in compliance with the prior informed consent arrangements set out in the Convention.

With regard to Article 4. Mercury-added products, the inventory highlights the significant contribution of mercury-added products to total mercury emissions and releases in Ghana. Further investigation of these inventory sub-categories is warranted as the precautionary assumption made in this preliminary assessment are likely to generate overestimates of the mercury emissions and releases. Nevertheless, Ghana will need to consider what measures it will need to take to meet the obligation in paragraph 1 of the article with regard to mercury-added products listed in Annex A Part I.

A number of these products listed in Annex A Part I, and identified as important in the inventory results, are destined for use in the health sector so that

changes in procurement policies may be required. Furthermore, given the reported prevalence of amalgam use in dental restorations, a health sector strategy with regard to its phase-down will be needed to meet obligations in paragraph 3 and Annex A Part II.

Lastly, inventory work has identified the local presence and possible use of mercury-containing medical instruments that are not currently listed in Annex A Part I. Ghana may wish to submit a proposal for listing such items pursuant to paragraph 7.

With regard to Article 5. Manufacturing processes in which mercury or mercury compounds are used, none of the processes listed in either Part I or Part II of Annex B have been identified in Ghana during inventory work. In meeting the obligation set out in paragraph 6, Ghana may need to consider measures to ensure that no new facilities using the manufacturing processes listed in Annex B are established.

With regard to Article 7: Artisanal and small-scale gold mining, given the extremely serious health impacts resulting from ASGM activities in identified ASGM communities. Ghana may need to take actions to address the obligations set out in paragraph 3 and Annex C

With regard to Article 8: Emissions, the inventory has identified the economic importance to Ghana of a number of the point source categories listed in Annex D.

It follows that Ghana will need to consider measures to meet obligations set out in paragraphs 3 to 7 including actions to control emissions from existing and new sources, where appropriate, to require the use best available techniques and best environmental practices.

With regard to Article 9: Releases, Ghana will need to consider whether any of the inventory sub-categories identified as giving rise to significant releases to land and water need to be addressed under this article.



With regard to Article 10: Environmentally sound interim storage of mercury other than waste mercury, Ghana may not need to consider measures under this article as manufacturing processes constituting mercury use have not been identified. The obligations set out in this article may however be considered in drawing up an action plan for ASGM that includes efforts to manage the trade of mercury in that sector.

With regard to Article 11: Mercury wastes, the inventory highlights the significance to the total mercury emissions and releases in Ghana of the disposal of mercury-containing products, including products imported at or near end-of-life. It follows that Ghana will need to consider appropriate measure to meet obligations set out in paragraph 3.

With regard to Article 12: Contaminated sites, only a very preliminary consideration of sites likely to be contaminated has been possible during this work. Nevertheless, a number of sectors likely to give rise to

sites contaminated by mercury are recognized. Further work to develop an appropriate strategy for identifying and assessing such sites will be required to meet obligations set out in paragraphs 1 and 2.

With regard to Articles 16: Health aspects, and Article 18: Public information, awareness and education, the inventory highlights the potential exposure to mercury, and the lack of awareness of such risks, of a number of population groups. The health and communications need of these groups are considered in more detail in Chapters 4 and 5 below.

In order to meet the obligations of these and other articles of the convention, Ghana will need to establish legal, regulatory and institutional frameworks to manage its actions as a Party to the convention and to identify financial resources to take up actions. These aspects are dealt with in the following chapters.

# Chapter Three



## POLICY, REGULATORY AND INSTITUTIONAL FRAMEWORK ASSESSMENT

### 3.1 POLICY AND REGULATORY ASSESSMENT

This chapter is devoted to a situational analysis and assessment of the existing domestic policy, institutional and regulatory frameworks to determine their adequacy or otherwise to meeting Ghana's obligations under the Convention.

At the institutional level, the report considers a broad range of actors mostly government ministries and agencies whose mandates have a direct or indirect bearing on the subject of protecting human health and the environment from man-made emissions and releases of mercury and mercury compounds. Also covered under this section are non-governmental organizations that have important roles to play in achieving the objective of the convention. The information here is mostly drawn from the official websites of the institutions as well as through personal interviews and responses to questionnaires. Within the regulatory context, the section examines a broad range of laws and regulations that were fashioned before Ghana became a party to the Convention. Admittedly therefore, there are deficiencies in terms of the Convention obligations as far as the national legal framework is concerned. These shortfalls are dealt with in a gap analyses and some recommendations are made on filling these gaps.

At the policy level, there is the National Environment Policy (NEP). The current NEP is a revised version of the original that was adopted around 1992. Ghana is a member of the sub-regional ECOWAS. Reference is therefore made to a Directive which has a bearing on the subject of the Convention.

In terms of legal hierarchy, the Constitution is the fundamental law of the land and constitutes the basis for all other laws in Ghana. It is followed by Acts of Parliament and subsidiary legislation. including legislative instruments passed by Parliament and by-laws made by local authorities.

At the sub-regional level, Ghana is a member of the

Economic Community of West Africa States (ECOWAS), and the African Union at the continental level.

Ghana has ratified the Minamata Convention on Mercury (hereinafter referred to as "the Convention"). By the act of ratification, Ghana agreed to be bound by the obligations imposed on Parties by the Convention.

As noted in the memorandum to cabinet seeking approval for Ghana to become a member of the Convention:

"The obligations arising from the ratification of the Convention are a commitment to comply with and implement its provisions and the enactment of a national law, if necessary, to give effect to our obligations under the Convention."

#### 3.1.1 THE GHANA CONSTITUTION

The 1992 Constitution of Ghana provides the broad policy basis for the protection of human health and the environment. The relevant sections are as follows:

- Economic Development - Article 36 (9): The State shall take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek co-operation with other states and bodies for the purposes of protecting the wider international environment for mankind.
- Economic Development - Article 36 (10): The State shall safeguard the health, safety and welfare of all persons in employment, and shall establish the basis for the full deployment of the creative potential of all Ghanaians.
- Duties of a Citizen - Article 41 (k): The exercise and enjoyment of rights and freedoms is inseparable from the performance of duties and obligations, and accordingly, it shall be the duty of every citizen to protect and safeguard the



environment Article 268 of the 1992 Constitution states that “Any transaction, contract or undertaking involving the grant of a right or concession by or on behalf of any person including the Government of Ghana, to any other person or body of persons howsoever described, for the exploitation of any mineral, water or other natural resource of Ghana made or entered into after the coming into force of this Constitution shall be subject to ratification by Parliament.

### 3.1.2 NATIONAL ENVIRONMENT POLICY

Ghana has adopted a National Environment Policy (NEP) of 2012 which among other things aimed at:

“taking appropriate measures irrespective of existing levels of environmental pollution and extent of degradation to control pollution and the importation and use of potentially toxic chemicals.”

Included in the operational principles to the adopted in the implementation of the policy are global and international cooperation consistent with minimization and avoidance of waste at source and particular attention would be paid to toxic and hazardous wastes.

In the area of strategic goals, the policy covers all sectors including a goal addressing an effective institutional and legislative framework. Under this goal, government undertakes to create an effective, adequately resourced and harmonized institutional framework centered around MESTI and EPA as well as an integrated legislative system and improve institutional capacity in both areas.

Under the institutional framework, government commits to conduct audit and review existing skills, capacities, functions and deployment of resources in the Agency as the lead institution. Institutional options will also be further investigated including the creation of new ones.

Under the policy, a legislative audit will be carried out

for the purpose of establishing among others:

- a process of regular reviews of the relevance and appropriateness of all government policies, strategies, plans, legislation and standards that have impacts on the environment in order to update them in line with emerging developments in environmental management.
- domesticating international treaty law to which Ghana is a party.

On the subject of pollution prevention and control, the policy aims, among others, to prevent, reduce and control pollution in any part of the environment resulting from any form of human activity especially toxic and other hazardous substances including setting targets to minimize waste generation and pollution at source; adopting the polluter-pays-principle and endorsing the precautionary principle; formulate and implement a country-wide strategy and guidelines on the management of wastes including those that may contain potentially hazardous materials.

### 3.1.3 ENVIRONMENTAL PROTECTION AGENCY ACT, 1994 (ACT 490)

While there are a number of sector specific laws on the environment, the principal legislation on the subject in Ghana, is the Environmental Protection Agency Act, 1994 (Act 490). Two regulations have so far been adopted under this Act; Environmental Assessment Regulation, 1999 (LI 1652) and Management of Ozone Depleting Substances and Products Regulations, 2005 (LI 1812).

There are a number of provisions in existing law that has relevance to the implementation of the Convention. In this regard, Sections 2 (a), (c), (d), (f), (h) (l) of Act 490 are relevant and cover advisory, coordinating, permitting, cooperation, education, collaborative, compliance, and compliance mandates, among others. The details are contained in Table 3.1.



Section 10 establishes the Hazardous Chemicals Committee which is a thirteen-member committee chaired by the Executive Director of the Agency with the following functions

- To monitor the use of hazardous chemicals by collecting information on the importation, exportation, manufacture, distribution, sale use, and disposal of those chemicals;
- To advise the Board and the executive director on the regulation and management of hazardous chemicals; and
- To perform any other functions relating to chemicals that the board or the executive director may direct.

### 3.1.3.1 REGULATIONS

Section 62 of the Act grants the power to make regulations Under this section, the Minister may, on the advice of the Board, by legislative instrument, make regulations for, among others, the following:

s62(1)(a) standards and code of practice relating to the protection, development and rehabilitation of the environment;

s62(1)(c) the type, quantity, conditions or concentration of substances that may be released into the environment;

s62(1)(d) the manufacture, importation, use, collection, storage, recycling, recovery or disposal of substances which may be hazardous to the environment; and

s62(1)(e) the disposal of waste generally.

The sheer scope and reach of the powers under this Act, leaves no doubt about the intent of the law makers to give to the Agency the widest degree of ambit possible to enable it protect the environment. In the implementation of the Convention therefore, the Agency is the institution with the powers to take charge and lead the process for the realization of the objective of the Convention. It is appropriate that it

will play the role of National Focal Point and become the fulcrum around which all the activities for the successful implementation of the Convention will revolve. It is noted that the Agency is already engaged in multi-agency collaboration with several institutions including the private sector and NGOs in matters relating to the management of chemicals.

### 3.1.3.2 ENVIRONMENTAL ASSESSMENT REGULATIONS 1999 (L.I. 1652)

Under section 62 of Act 490, the Minister is authorized to make subsidiary legislation to give effect to the provisions of the Act on the advice of the Board. Among others, the regulations may provide for:

“The category of undertakings, enterprises, constructions or developments in respect of which environmental impact assessment or environmental management is required by the Agency.”

The above provision formed the basis for the development and adoption of the environmental assessment regulations. Since these regulations entered into effect, they have become a major environmental management tool in Ghana. Some of its provisions are relevant to aiding Ghana achieve compliance with her obligations under the Convention particularly the category of undertakings in the schedules listed below

The regulations provide a category of undertakings in a schedule for which a particularly level of assessment may be triggered depending on the impact the undertaking may have on the environment or human health or both.

- **under LI 1652** the undertakings for which registration and an environmental permit is required are: mining of metal and non-metal mines; chemical and chemical products including industrial chemicals, soaps and cleaning products, as well as utilities and waste materials



The undertakings for which EIA is mandatory, are industry including chemical, petroleum, non-ferrous like smelting and non-metallic such as cement; mining and processing of minerals; waste treatment and disposal projects.

The relevance of these regulations to the Convention is that it makes EIA a mandatory requirement for undertakings which may involve the use of mercury or its compounds or result in emissions, releases and discharges containing mercury.

Under section 2 (h) of Act 490, the Agency in 2016 developed draft standards, sections of which are relevant to the Convention

Among the parameters to be measured with respect to Effluent Quality for the following industries are mercury and mercury compounds:

- Metal smelting and fabrication
- Paint
- Chemicals
- Paper products and allied products processing
- Thermal energy plants
- Publishing (case by case depending on type of chemical being used)
- Gold and other precious metal refining

For point source, stack air emissions and ambient air quality, parameters to be measured include mercury and mercury compounds.

The following standards have been developed:

- Sector specific Effluent Quality Guidelines for discharges into natural water bodies (2000);
- National Sector specific effluent quality draft standards (2016),
- Point source/stack air emission standards (2016)
- Draft ambient air quality standards (2016)

#### 3.1.4 HAZARDOUS AND ELECTRONIC WASTE CONTROL AND MANAGEMENT ACT, 2016 (ACT 917)

The Act was enacted to give effect to Ghana's

obligations under the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal, 1989, the Stockholm Convention on Persistent Organic Pollutants and the Rotterdam Convention on Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

It is: "An Act to provide for the control, management and disposal of hazardous wastes, electrical and electronic waste and for related purposes."

Among the categories of waste streams dealt with under the Act, are mercury and mercury compounds (First Schedule, Section 1(1) (B) Y29. Hazardous wastes is defined by reference to the listing in the First Schedule, which, as noted above, includes wastes from mercury and mercury compounds as well as clinical wastes from medical care in hospitals, medical centers and clinics.

Section 12 imposes a monitoring obligation on the Agency in the management of hazardous wastes in order to prevent any harmful effects of the wastes on human health and the environment. Under section 13, there is an obligation to prevent pollution from hazardous and other wastes and to minimize any effects where these occur.

Section 36 provides that the Minister, in consultation with the Agency and other relevant national authorities, may by legislative instrument, make Regulations for:

"the establishment of a Hazardous Wastes and Electronic Wastes Management Committee."

It is noted that there is already a Hazardous Chemicals Committee under section 10 of Act 490 and it is not clear how the proposed Committee under this Act will relate to the existing Committee in terms of composition and mandate. There are already too many overlaps in institutional mandates and additional ones need to be avoided.

The Act also incorporates the prior informed consent



procedure through the notification process for the transboundary movement of hazardous wastes.

Waste on the other hand is defined as: “substances or objects which are disposed of, intended to be disposed of or required to be disposed of.”

Collection is defined to include: “the environmentally sound mixing, bulking and sorting of wastes and interim storage at an approved site or facility for hazardous wastes and other wastes as well as waste generated in small quantities within the Republic.” This is important because Article 11 deals with mercury wastes.

Law Enforcement Officer is defined to include: “a nominated Customs Officer, a Member of the Ghana Armed Forces, a designated officer or an inspector of the Environmental Protection Agency, the Port Health Authority, the Ghana Atomic Energy Commission, and personnel of other institutions authorized in writing by the Minister who shall have the same powers, authority and privileges of a Police Officer.” This is consistent with the requirements under section 2 of Act 490 calling for cooperation between the Agency and relevant institutions in the discharge of its mandate. (Section 2 of Act 490 on Cooperation)

#### 3.1.4.1 HAZARDOUS, ELECTRONIC AND OTHER WASTES (CLASSIFICATION), CONTROL AND MANAGEMENT REGULATIONS, 2016 (L.I. 2250)

These regulations were made under the Hazardous and Electrical Waste Control and Management Act, 2016 (Act 917). Gazette notification was issued on 13 October 2016 and it entered into force on 6 January 2017. Among the purposes of the regulations are to:

- regulate the classification, control and management of wastes;
- prescribe requirements and time frames for the management of wastes listed in the First Schedule; and
- prescribe requirements for the disposal of wastes.

Under section 2, the Regulations are not applicable to a person who generates domestic waste which is collected by the District Assembly.

Under the First Schedule, the Regulations seek to address waste containing mercury from the following sources: petroleum refining, natural gas purification and pyrolytic treatment of coal and from inorganic chemical processes.

Also covered under this Schedule are wastes otherwise not specified in the list, including components containing mercury, batteries and accumulators and batteries containing mercury.

For municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions, fluorescent tubes and other mercury containing waste.

For waste streams, clinical wastes from medical care in hospitals, medical centers and clinics.

The Third Schedule of the Regulations deals with criteria for assessment of waste for landfill disposal including measurements for total concentrations and leachable concentrations of chemical substances including mercury.

The Act and its Regulations have direct relevance to Article 11 of the Convention on mercury wastes.

#### 3.1.5 MERCURY ACT, 1989 (PNDCL 217)

Covering 9 sections, this Act prohibits the importation of any quantity of mercury into Ghana except under a license. The prohibition also covers possession, purchase, sale or transfer. The penalty for breach is a fine, imprisonment or both.

Small scale miners are permitted to purchase, from licensed mercury dealers: “such reasonable quantities of mercury as may be shown to be necessary for the purpose of their mining operations.” The small-scale gold miners are required to: “observe good mining practices in the use of mercury for carrying out mining operations.”



Under section 2, the trade ministry is responsible for the implementation of this law. It is not too clear why this was done. Other sections cover power to grant and revoke a licence (section 2); buying and transferring mercury from or to an unauthorized person.

Section 7 is significant in shifting the traditional burden of proof. The burden is placed on the accused charged for dealing in or possessing mercury, to prove that he holds a valid licence to possess or deal in such mercury.

Section 9 defines mercury as: “the metal known as mercury or quicksilver.”

The law appears to have been made during an era of import licensing which is a far cry from the present liberalized trade regime. At the time of its adoption, the focus was on revenue yields rather than protection of human health or the environment and this is clear from its provisions. This may account for its institutional placement under the trade ministry which is the administrator of the license regime instituted by the law.

While the law is still in force, information from the trade ministry shows that no licenses have been issued in 2017. This is clearly a law which requires to be reviewed both in terms of substantive and administrative arrangements. Overall, its effectiveness in meeting Ghana's obligations under the Convention can be said to be highly inadequate, including in the definition of mercury.

The Mercury Act needs to be replaced with a new law that broadly covers the provisions of the Convention and gives effect to our obligations particularly in areas that have not been addressed by existing legislation.

Appropriate sections may be saved and at the institutional level, a consideration must be given to placing the mandate for implementation under the EPA which has the personnel, skills and experience to deal with this subject.

### 3.1.6 MINERALS AND MINING ACT, 2006 (ACT 703), AS AMENDED

This is an Act revising and consolidating mining and minerals law. It empowers the minister after consulting the Minerals Commission, to designate areas for ASM operations. The minister currently responsible for this Act is the Minister for Lands and Natural Resources. The Act was amended in 2010 and 2015 to enable the Minister to prescribe the rate of royalty payments (formerly fixed at five per cent), and second, to enable the confiscation of equipment used in illegal artisanal and small-scale mining operations.

This Act repeals the Minerals and Mining Act, 1986 (PNDC 153) and Small-Scale Gold Mining Law, 1989 (PNDC 218) among others and incorporates existing laws and regulations on the sale of mercury and minerals, use of explosives, requirement for environmental permits, etc.

Section 96 provides that a small-scale miner may purchase from an authorized mercury dealer, the quantities of mercury that may be reasonably necessary for the mining operations of the small-scale miner. The provision is similar to section 4 of the Mercury Act from where it appears to have been borrowed.

If the Mercury Act is outdated and does not bring Ghana into full compliance with its obligations under the Convention, then this section of Act 703 is by extension also obsolete and must be revised.

Section 93 which deals with the operations of small scale miners provides that a licensed operator may win, mine and produce minerals by an effective and efficient method and shall observe good mining practices, health and safety rules and pay due regard to the protection of the environment during mining operations.

At the institutional level, section 92 provides for the establishment of a small-scale mining committee made up of political, traditional and governmental appointees including an officer of the EPA. The mandate of the committee who are appointed by the



Minister is to:

“assist the district office to effectively monitor, promote and develop mining operations in the designated area.”

### 3.1.6.1 MINERALS AND MINING (HEALTH, SAFETY AND TECHNICAL) REGULATIONS, 2012 (L.I. 2182)

The Minerals and Mining Regulations (Health, Safety and Technical) 2012 (LI 2182) establishes environmental, safety, machinery and related guidelines for mining operations. Regulation 473 requires the written permission from the Chief Inspector of Mines to use mercury and also requires the use of a retort for small-scale mining activities. Regulation 474 requires the safe handling of mercury.

### 3.1.7 PUBLIC HEALTH ACT, 2012 (ACT 851)

The Food and Drugs Authority under the Ministry of Health is responsible for the implementation of this Act.

Section 111 prohibits the sale of drugs, herbal, medicinal products, cosmetics, medical devices and other household chemical substances. It is noted that the definition of cosmetics does not cover mercury content.

Section 148 deals with guidelines and codes of practice. Under this section, the Authority may issue guidelines and codes of practice in connection with food and drugs and any other products or devices regulated by the Authority and affected persons are obliged to comply with the guidelines and codes of practice.

The Authority may issue guidelines among others, for, “the regulation of importation or exportation of food, drugs, herbal medicines, cosmetics, medical devices or household chemical substances in order to ensure compliance with this Part.” Failure to comply will lead to payment of an administrative penalty. Failure to pay is criminalized with accompanying penalties.

Consistent with the above powers, the FDA on 1st March 2013 issued Guidelines for importation of cosmetics and household chemical substances. FDA/MCH/CHC/GL-ICH/2013/01

Section 6.4 deals with banned products and (b)(4) bans all mercury based products.

The implementation of Act 917 and its L.I. 2250 should complement developments under the Public Health Act. The Ghana Health Service, the Agency Customs Division of GRA and the FDA may cooperate in respect of the provisions under Article 16 of the Convention.

### 3.1.8 FACTORIES, OFFICES AND SHOPS ACT, 1970 (ACT 328)

Passed over 40 years ago, this remains the principal law in force dealing with matters of occupational health and safety in Ghana.

It deals with registration of factories, notification of occupational accidents and illnesses, health and welfare standards, safety measures and complaints in relation to dangerous conditions and practices among others.

Between 1970 and 2017 there have been a lot of developments in the area of occupational health and safety which has clearly made the law outdated. The need for change has been recognized and the MELRs have been working on replacing the law with one that incorporates modern concepts and principles of occupational health and safety.

### 3.1.9 LABOUR ACT, 2003 (ACT 651)

This is the principal law on all aspects of labour in Ghana. Section 58 prohibits the engagement of young persons in any type of employment or work likely to expose the person to physical or moral hazard.

Part XV is devoted to occupational, health, safety and environment while section 58 imposes an obligation



on employers to ensure that every worker employed by him or her, works under satisfactory, safe and healthy conditions.

This obligation includes among others, the following:

- Provide and maintain at the workplace, plant and system of work that are safe and without risk to health;
- Ensure the safety and absence of risks to health in connection with use, handling, storage and transport of articles and substances;
- Provide the necessary information, instructions, training and supervision having regard to the age, literacy level and other circumstances of the worker to ensure, so far as is reasonably practicable, the health and safety at work of workers engaged on the particular work;
- Take steps to prevent contamination of the workplace by, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety and health;
- Supply and maintain at no cost to the worker adequate safety appliances, suitable fire-fighting equipment, personal protective equipment, and instruct the workers in the use of the appliances or equipment;
- Prevent accidents and injury to health arising out of, connected with, or occurring in the course of, work by minimizing the causes of hazards inherent in the working environment.

There are obligations on the worker as well principally requiring the use of the safety appliances and personal protective equipment provided by the employer in compliance with the instructions given.

### 3.1.10 LOCAL GOVERNANCE ACT, 2016 (ACT 936)

The new Act harmonizes five existing legislations on local governance and provides a one stop shop document on all local governance issues.

The planning functions of the district assembly are exercised by the District Planning Authority including:

- Responsibility for the development, improvement and management of human settlements and the environment in the district
- Coordinating, integrating and harmonizing the execution of programmes and projects under approved development plans for the district and other development programmes promoted or carried out by Ministries Departments, public corporations and other statutory bodies and non-governmental organisations in the district.
- Carrying out studies on development planning matters in the district that include studies on economic, social, spatial, environmental, sectoral and human settlement issues and policies
- Synthesizing the policy proposals on development planning in the district into a comprehensive framework for the economic, social and spatial development of the district including human settlements and ensure that the policy proposals and projects are in conformity with the principles of sound environmental management

Other relevant provisions of the law in relation to the environment are as follows:

- A person who discharges the duties of a Medical Officer or sanitary Inspector under the Public Health Act, 2012 (Act 851) shall be an officer of the District Assembly of that area to give effect to and enforce by-laws related to



public health made by the District Assembly.

- A person shall not carry out a physical development in a district except with the prior written approval in the form of a written permit issued by the District Planning Authority. "Physical development" is defined as: the carrying out of building, engineering, mining or other operations on, in, under or over land, or the material change in the existing use of land or a building and includes the subdivision of land, the disposal of waste on land including the discharge of effluent into a body of still or running water and the erection of advertisement or other hoarding.

### 3.1.10.1 ENFORCEMENT AGAINST NUISANCE

96. (1) A District Planning Authority may serve notice on a person to abate a nuisance within a specified time where substantial injury to the environment, amenity, public health or the economy has been caused by the nuisance or is likely to be caused from the action or inaction of that person.

Nuisance is defined as: any activity, operation, works, action, neglect or any effect of it on, in, under or over land which is offensive, injurious or prejudicial to amenity, public health, public safety, public peace, public convenience or the local or national economy;

A District Assembly may make by-laws for the purpose of any function conferred on that District Assembly by this Act or any other enactment.

Bye-laws on waste management are important when it comes to the implementation of the convention as far as waste management in our districts, municipalities and metropolises are concerned.

The inclusion of mining and waste disposal in the Act makes it critical to the effective implementation of the Convention. No such development can take place without a permit from the DA. ASGM takes place in

the districts and the permit of the DA is therefore required before this can be done. The same goes for waste disposal on land.

## 3.2 INSTITUTIONAL ASSESSMENT

### 3.2.1 MINISTRY OF ENVIRONMENT, SCIENCE, TECHNOLOGY AND INNOVATION

The Ministry of Environment, Science, Technology and Innovation (MESTI), which forms part of government machinery, was established in 1993 as the Ministry of Environment and Science. In 2006, the Ministry was dissolved. Its portfolios on Environment and Science were added to the Ministry of Local Government and Rural Development (MLGRD); and the Ministry of Education respectively. In January 2009, the Ministry was reconstituted and named Ministry of Environment, Science and Technology (MESTI), under Executive Instrument (E.I.) 7 Civil Service (Ministries) Instrument, 2009. However, in 2013, the Ministry was renamed Ministry of Environment, Science, Technology and Innovation (MESTI), under Executive Instrument (E.I.) 1 Civil Service (Ministries) Instrument, 2013.

#### VISION

MESTI envisages to attain sustainable development through the utilization of Science, Technology and Innovation for wealth creation and sound environmental governance in a modern and competitive Economy.

#### MISSION

MESTI exists to promote sustainable development by deepening and strengthening market driven Research and Development (R&D) for sound Environmental Governance, Science, Technology and Innovation through intensive awareness creation, collaboration and partnership.



## ADOPTED POLICY OBJECTIVES

The Ministry has adopted a number of policy objectives from the Ghana Shared Growth Development Agenda (GSGDA II) including the following:

- Strengthen institutional and regulatory frameworks for sustainable natural resource management;
- Promote the application of Science, Technology and Innovation in all sectors of the economy;
- Strengthen the institutional framework to promote the development of research and its application;
- Strengthen policy formulation, development planning, and M&E processes for equitable and balanced spatial and socio- economic development; and

The MESTI has a number of directorates some of which are relevant to the subject of implementation of the convention including on: policy, planning, monitoring and evaluation and environment, and these are:

At the institutional level, the MESTI is at the apex of the political and policy making structure in the environmental governance system. The EPA falls directly under its supervision and reports to it. The centrality of its role in the successful implementation of Ghana's obligations under the Convention cannot therefore be over emphasized.

### 3.2.2 ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency is the leading public body responsible for protecting and improving the environment in Ghana. The Agency was formally established on 30th December 1994 by Act 490 and given the responsibility of regulating the environment and ensuring the implementation of Government policies on the environment.

The erstwhile Environmental Protection Council (EPC)

was established by the Environmental Protection Council Decree 1974 (NRCD 239) and was subsequently amended by the EPC (Amendment) Decree 1976 (SMCD 58).

The EPC was mainly an advisory body to Government on issues relating to the environment. However, with the creation of a Ministry responsible for the Environment (Ministry of Environment, Science and Technology), it became increasingly necessary to redefine the role of the EPC, particularly since its policy formulation role moved to the Ministry.

The Environmental Protection Agency Act, 1994 (Act 490) transformed the Environmental Protection Council into an Agency having, inter alia, regulatory and enforcement powers.

## VISION

An Agency dedicated to continuously improving and conserving the country's environment in which all sections of the community value the environment, strive to attain sustainable development, effective and efficient resource management based on good environmental governance, taking into account social and equity issues.

## MISSION

The mission of the EPA of Ghana is to co-manage, protect and enhance the country's environment, in particular, as well as seek common solutions to global environmental problems. The accomplishment of the mission is to be achieved inter alia through research, scientific, technological and innovative approaches, good governance and partnerships.

### 3.2.3 MINISTRY OF HEALTH

As a critical sector of the economy, the Ministry of Health (MOH) seeks to improve the health status of all people living in Ghana as a way of contributing to Government's vision of universal health coverage and a healthy population. The Ministry of Health, working in partnership with its agencies and stakeholders,



aims at improving the human capital thus "creating wealth through health" through the development and implementation of proactive policies that will ensure improved health and vitality.

#### VISION

The vision of the health sector is to have a healthy population for national development.

#### MISSION

The mission of MOH is to contribute to socio-economic development and the development of a local health industry by promoting health and vitality through access to quality health for all people living in Ghana using motivated personnel.

#### GOALS

To improve the health status of all people living in Ghana through effective and efficient policy formulation, resource mobilization, monitoring and regulation of delivery of health care by different health agencies.

The functions of the Ministry of Health are to:

- Formulate health policy.
- Set standards for the delivery of health care in the country.
- Provide strategic direction for health delivery services.
- Monitor and evaluate health service delivery by the Ghana Health Service (GHS) and the Teaching Hospitals, other Agencies, Development Partners and the Private sector.
- Develop policies for the practice of Traditional and Alternate Medicine in the country.
- Source funding for service delivery through GOG, Health Insurance and the international community.

- Allocate resources to all health care delivery agencies under the Ministry.
- Provide the framework for the development and management of human resources for the health sector.
- Provide a framework for the effective and efficient procurement, distribution, management and use of health sector goods, works and services.
- Make proposals for the review and enactment of legislation on health.
- Provide the framework for the regulation of food, drugs, health service delivery and practice.

#### 3.2.4 GHANA HEALTH SERVICE

The Ghana Health Service (GHS) is a Public Service body established under Act 525 of 1996 as required by the 1992 constitution. It is an autonomous Executive Agency responsible for implementation of national policies under the control of the Minister for Health through its governing Council - the Ghana Health Service Council.

The GHS continue to receive public funds and thus remain within the public sector. However, its employees will no longer be part of the civil service, and GHS managers will no longer be required to follow all civil service rules and procedures.

The independence of the GHS is designed primarily to ensure that staffs have a greater degree of managerial flexibility to carry out their responsibilities, than would be possible if they remained wholly within the civil service. Ghana Health Service does not include Teaching Hospitals, Private and Mission Hospitals

#### MANDATE

To provide and prudently manage comprehensive



and accessible health service with special emphasis on primary health care at regional, district and sub-district levels in accordance with approved national policies.

#### FUNCTIONS

For the purposes of achieving its objectives, the GHS will perform the following functions amongst others:

- Provide comprehensive health services at all levels directly and by contracting out to other agencies. As part of this function, the GHS will:
- Develop appropriate strategies and set technical guidelines to achieve national policy goals/objectives
- Undertake management and administration of the overall health resources within the service Promote healthy mode of living and good health habits by people
- Establish effective mechanism for disease surveillance, prevention and control
- Perform any other functions relevant to the promotion, protection and restoration of health.

#### 3.2.5 FOOD AND DRUGS AUTHORITY

The Food and Drugs Authority (FDA) formerly the Food and Drugs Board (FDB) was established in August 1997 under the Food and Drugs Law, 1992 (PNDCL 305B). It is the National Regulatory Authority mandated by the public Health Act, 2012 (Act 851) to regulate food, drugs, food supplements, herbal and homeopathic medicines, veterinary medicines, cosmetics, medical devices, household chemical substances, tobacco and tobacco products.

The FDA Ghana's legal mandate is found in part 6 (Tobacco Control Measures), part 7 (Food and Drugs), and part 8 (Clinical trials) of the Public Health Act, Act

851 of 2012. The FDA is an Agency under the Ministry of Health.

The objective of the Authority is to provide and enforce standards for the sale of food, herbal medicinal products, cosmetics, drugs, medical devices and household chemical substances.

#### FUNCTIONS OF THE AUTHORITY

- a) Ensure adequate and effective standards for food, drugs, cosmetics, household chemicals and medical devices;
- b) Monitor through the District Assemblies and any other agency of State compliance with the provisions of Part 6,7 and 8 of the Public Health Act,2012 (ACT 851);
- c) Advise the Minister on measures for the protection of the health of consumers;
- d) Advise the Minister on the preparation of effective Regulations for the implementation of Part 6,7 and 8 of the Public Health Act, 2012 (ACT 851)

#### 3.2.6 MINISTRY OF TRADE AND INDUSTRY

The Ministry of Trade & Industry (MoTI) is the lead policy advisor to government on trade, industrial and private sector development with responsibility for the formulation and implementation of policies for the promotion, growth and development of domestic and international trade and industry. This Ministry is also responsible for implementing the Mercury Act.

#### CORE FUNCTIONS

Among the core functions of the Ministry are to:

- formulate and harmonize policies that will ensure inter-sectoral collaboration in the implementation of trade and industrial policies both at national and global levels.
- develop programmes and activities for



institutional capacity building to meet the challenges of the global market.

- develop standards and Quality Systems to meet production requirements for local and international markets.
- collect, collate process, store and disseminate timely and accurate information for stakeholders.
- facilitate the removal of institutional and legal bottlenecks.

MoTI is responsible for

- Policy formulation.
- Development and enforcement of standards in trade and industry.
- Promoting and facilitating Ghana's internal and export trade with emphasis on diversification and value-addition.
- Promoting and facilitating Ghana's active participation in global trade through participation in multilateral and pluri-lateral institutions as well as championing Ghana's market expansion drive.

### 3.2.7 MINERALS COMMISSION

The Minerals Commission is a government agency established under Article 269 of the 1992 Constitution and the Minerals Commission Act. The Minerals Commission as the main promotional and regulatory body for the minerals sector in Ghana is responsible for:

“the regulation and management of the utilization of the mineral resources of Ghana and the coordination and implementation of policies relating to mining”.

It also ensures compliance with Ghana's Mining and Mineral Laws and Regulations through effective monitoring.

The Commission's primary responsibility is to foster the efficient and effective regulation and management of the utilization of Ghana's mineral resources. This we will accomplish through the development of a solid, knowledge-based, self-led organization, which recognizes that mining investment would take place and be sustained only if it is under win-win circumstances.

### FUNCTIONS

Specifically, the Commission is required by law to carry out the following functions:

- Formulate recommendations of national policy for exploration and exploitation of mineral resources with special reference to establishing national priorities having due regard to the national economy;
- Advise the Minister of Lands and Natural Resources on matters relating to minerals;
- Monitor the implementation of laid down Government Policies on minerals and report on this to the Minister;
- Monitor the operations of all bodies or establishments with responsibility for minerals and report to the Minister;
- Receive and access public agreements relating to minerals and report to Parliament;
- Secure a firm basis of comprehensive data collection on national mineral resources and the technologies of exploration and exploitation for national decision making; and
- Perform such other functions as the Minister may assign to it.

In fulfilling its functions, the Commission engages in the following activities:



- Investigate the background, process applications for mineral rights and recommend their grant or otherwise to the Minister;
  - Review agreements relating to minerals; Collect, collate and analyze data on the operations of mining companies for decision making and for dissemination;
  - Organize and attend workshops/ seminars/ conferences, as well as issue publications to promote mineral sector activities;
  - Liaise with other governmental agencies, notably the Bank of Ghana, the Internal Revenue Service (IRS) and the Customs, Excise and Preventive Service (CEPS), to ensure that the spirit of the sector's fiscal regime is maintained;
  - Liaise with other governmental agencies, notably the Geological Survey Department (GSD) and the Environmental Protection Agency (EPA) to monitor and ensure the adherence of mining companies to the terms and requirements of the mineral rights granted to them.
- foreign policy are contained in Ghana's 1992 Constitution. Article 40 of the Constitution provides the broad principles underpinning her foreign policy as follows:
    - Promotion and protection of the interest of Ghana; of a just and equitable international, economic, political and social order;
    - Promotion of respect for international law and treaty obligations;
    - Promotion of the settlement of international disputes through peaceful means; and
    - Adherence to the principles enshrined in the Charter and aims or ideals of the United Nations, the African Union, the ECOWAS, the Commonwealth and the Non-Aligned Movement.

Inspectorate Division and District Offices of the Commission have been established to ensure compliance with the minerals and mining regulatory regime in respect of formalized operations

According to the Commission, a major challenge confronting the ASM sector in Ghana is the informal sector i.e. illegal mining. The ineffectiveness of law enforcement has been a major contributory factor to the problem and creates an avenue for illegal mining sites to become conduits for the unofficial flow of mercury into the ASM sector.

### 3.2.8 MINISTRY OF FOREIGN AFFAIRS AND REGIONAL INTEGRATION

The fundamental principles that guide Ghana's

Representatives of Ghana's foreign missions are usually part of the negotiating delegation to international treaty meetings. Additionally, they play an important role when it comes to membership of a treaty by preparing the instrument of ratification, accession or approval as the case may be for the signature of the head of state and ensures that the instrument is thereafter deposited with the depository prescribed by the particular treaty.

### 3.2.9 GHANA REVENUE AUTHORITY- CUSTOMS DIVISION

In December 2009, the three revenue agencies that is CEPS, IRS, VAT Service and RAGB Secretariat were merged in accordance with the Ghana Revenue Authority Act, 2009 (Act 791). GRA thus replaces the revenue agencies in the administration of taxes and customs duties in the country

The Customs Division is responsible for collection of Import Duty, Import VAT, Export Duty, Petroleum Tax, Import Excise and other taxes.



The Customs Division also ensures the protection of revenue by preventing smuggling. This is done by physically patrolling the borders and other strategic points, examination of goods, and search of premises, as well as documents relating to the goods. As a frontline institution at the country's borders, Customs Division also plays a key role in surmounting external aggression and maintains the territorial integrity of Ghana. Customs Division is part of the country's security network.

In addition to these functions, Customs Division performs agency duties on behalf of other government organizations and Ministries by seeing to the enforcement of laws on import and export restrictions and prohibitions.

The important role of our customs officials in the success of any enforcement efforts, has been recognized through several years of collaboration with the Agency in the implementation of chemical regulations including in the enforcement of the provisions of the Management of Ozone Depleting Substances and Products Regulations, 2005 (L.I. 1812) which was adopted to give effect to Ghana's obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer. Regulation 14 deals with customs verification and labelling and gives direct roles to customs officers relating to the import and export of controlled substances.

Under Act 490, the Customs Division serves on the Pesticides Technical Committee and section 61

“Customs officer

- (a) shall assist in the enforcement of this Act and
- (b) shall prevent the importation of a pesticide where the importation is contrary to this Act” .?

The regulation also requires the Agency to provide the head of The Customs Division with some records while the Commissioner is in turn obliged to keep certain records copies of which must be made available to the Agency on request.

Under Act 917 Law Enforcement Officer is defined to include a nominated Customs Officer underscoring their importance for the effective implementation of the provisions of the Convention.

### 3.2.10 MINISTRY OF LOCAL GOVERNMENT AND RURAL DEVELOPMENT

The Ministry of Local Government and Rural Development and its departments and agencies belong to the Central Management Agencies category of Government Machinery with the mandate to ensure good governance and balanced development of Metropolitan, Municipal and District Assemblies (MMDAs). The Ministry derives its mandate from the 1992 constitution and section 12 of the PNDCL 327 which provides the responsibilities of Ministries.

The Ministry of Local Government and Rural Development (MLGRD) exists to ensure good governance and balanced development of Metropolitan, Municipal and District Areas through:

- The formulation of policies on Governance (including decentralization policies), Rural/Urban Development and Environmental Sanitation; and Guidelines on the acquisition and use of human and financial resources by Assemblies;
- The development, improvement and management of human settlements and the environment in the district.
- The development of sector plans; and the provision of management advisory services to the Assemblies.
- The design and delivery of systems to set targets for and monitor the performance of Assemblies.

There are currently 216 district assemblies in Ghana including metropolitan and municipal assemblies. These assemblies are responsible for sanitation in



their various areas of jurisdiction. Principally, this has to do with waste management and has been a major challenge through the years. With no designated landfill sites or properly engineered landfills, illegal dumping of unsegregated waste is the order of the day.

### 3.2.11 MINISTRY OF FINANCE

The Ministry of Finance (MoF) exists to ensure macro-economic stability for promotion of sustainable economic growth and development of Ghana and her people through:

- The formulation and implementation of sound financial, fiscal and monetary policies.
- Efficient mobilization, allocation and management of financial resources.
- Establishing and disseminating performance-oriented guidelines and accurate user- friendly financial management information systems.
- Creating an enabling environment for investment. In furtherance of the foregoing the Ministry is committed to the pursuit of excellence, transparency, probity and accountability in the management of financial resources.

#### FUNCTIONS:

- Formulate and implement sound fiscal and financial policies
- Effective mobilization and efficient allocation of resources
- Improve public financial management

MoF is responsible for:

- Mobilization of external and internal resources
- Allocation of resources to all sectors of the economy

- Ensuring sustainability of the public debt
- Preparation and implementation of the annual budget and economic and financial statement of Government
- Management of public expenditure
- Development and implementation of financial sector policies

The MOF plays a key role in the mobilization of resources for national development. In the context of funding for the implementation of the Convention, it will coordinate donor resources as well as monitor its prudent disbursement.

### 3.2.12 MINISTRY OF EMPLOYMENT AND LABOUR RELATIONS

The Ministry of Employment and Labour Relations (MELR), established by Executive Instrument 1 (EI 1) issued in January 2013, and by Sections 11 and 13 of the Civil Service Act, 1993 (PNDC Law 327), is the lead policy advisor to Government on matters pertaining to employment and labour relations. There are a number of vocational training institutions in the country and this Ministry has oversight responsibility for them and they can play an instrumental role in training related to Minamata compliance

The Ministry oversees and coordinates employment opportunities and labour-related interventions in all sectors; and is thus responsible for the formulation and implementation of policies aimed at creating and promoting decent jobs, as well as for developing strategies that promote industrial peace and harmony. MELR resolves labour-related disputes in the country, ensures that the occupational safety and health of all workers in both the formal and informal sectors are guaranteed; and also regulates the payment of fair and equitable wages and salaries to employees in all sectors.

The Ministry executes its responsibilities through internationally acceptable practices of tripartite



consultations with the Sector's Social Partners.

The Ministry is mandated to formulate, plan, coordinate, monitor and evaluate policies, programmes/projects and the performance of the Employment & Labour Relations Sector towards accelerated employment generation for national development; to promote harmonious industrial (labour) relations and ensure workplace safety; as well as to create an enabling policy environment and opportunities for profitable job creation, career and professional development.

The mandate of the Ministry to ensure that the occupational safety and health of all workers are guaranteed, is what makes it an important institution in the holistic attainment of the objectives of the convention particularly in the area of human health. Published papers and available evidence paints a horrible picture of serious exposure of vulnerable groups especially women and children to various risks arising from the mercury in artisanal mining in Ghana.

### 3.2.13 DEPARTMENT OF FACTORIES INSPECTORATE

Department of Factories Inspectorate provides national leadership in Occupational Safety and Health. The Department seeks to find and share the most effective ways of getting results to save lives, prevent injuries and diseases at all workplaces.

The mission of the Department is to promote measures that would safeguard the health and safety of persons employed in premises, which fall within the purview of the Factories, Offices and Shops Act, 1970 (Act 328)

The Department also seeks to prevent occupational accidents and diseases that arise from exposure to stresses in the working environment by the promotion and enforcement of measures that would safeguard the health and safety of workers.

Among its functions are the following:

- Inspection of workplaces to ensure that reasonable standards of safety and health of workers are maintained;
- Prosecution of offences under the establishment Act;
- Occupational health and safety educational programmes;
- Organization of health and safety courses for target groups of workers and management.

### 3.2.14 NATIONAL LABOUR COMMISSION

Established in 2005, under section 135 of the Labour Act 2003 (Act 651), its law applies to all workers as well as employers with the exception of the Ghana Armed Forces. Police Service, Prison Service and other Security and Intelligence Agencies provided for under the Security and Intelligence Agencies Act 1996 (Act 526). Customs Excise and Preventive Service (CEPS) is also excluded by a Supreme Court decision.

Its major mandate includes receiving labour-related complaints, facilitating the settlement of Industrial disputes, settling industrial disputes and promoting effective cooperation between labour and management.

In this regard, it is important to acknowledge the role of the Commission as it has since its inception recorded thousands of complaints and subsequently settled over 70 percent of them.

These achievements form part of the Commission's vision to have a harmonious industrial relations environment borne out of the firm undertaking and committed compliance with the Labour Laws by all stakeholders in order to make the Ghanaian economy competitive to attract investment.

As part of its mission, the Commission is to develop and sustain a peaceful and harmonious industrial relations environment, through the use of cooperation among the labour market players and mutual respect for their rights and responsibilities.



The NLC also performs other roles in areas such as investigating labour-related complaints, particularly, unfair labour practices and taking such steps as it considers necessary to prevent such disputes. It also maintains a data base of mediators and arbitrators.

Aside these fundamental activities, the Commission in the exercise of its adjudicating and dispute settlement functions, is not subject to the control or direction of any person or authority. In other words, it is an independent body and thus takes decisions without any interference from any quarters.

Further, the Commission has the powers of the High Court to receive complaints from workers, trade unions, and employers' organizations on industrial disagreements and allegations of infringement of any requirement of the Labour Act as well as the regulations made under the Act.

Others are to require an employer to furnish information and statistics concerning the employment of its workers and the terms and conditions of their employment in the form and manner the Commission considers necessary.

### 3.2.15 MINISTRY OF JUSTICE AND ATTORNEY GENERAL'S DEPARTMENT

Responsible for legal matters in relation to the exercise of executive powers of the state and legislative drafting in relation to the exercise of legislative powers of the state.

The Ministry hosts among other departments, the drafting section which is responsible for the process of preparing new laws or effecting amendments to existing legislation based on instructions from the sponsoring government Ministries.

### 3.2.16 MINISTRY OF INFORMATION

The Ministry plays the key role of communicating government development policies and programmes to the people.

To enable the Ministry on Information, do this, it has identified the need to develop a coherent outreach strategy for urgent implementation.

### 3.2.17 INFORMATION SERVICES DEPARTMENT (ISD)

ISD was set up as the Ministry's main public information and outreach arm and create awareness of government policies, programs and activities.

Promote Ghana's international marketing agenda.

Provide Public Relations support to government Ministries, departments, agencies and Ghana's missions abroad.

Get feedback from the public to government for policy reinforcement or redirection.

### 3.2.18 GHANA ATOMIC ENERGY COMMISSION

The Ghana Atomic Energy Commission was established by an Act of Parliament, Act 204 of 1963, as the sole Agency in Ghana responsible for all matters relating to peaceful uses of atomic energy. The Act 204 was amended in 1993 by PNDC Law 308 mainly to enable it to create other institutes under the Commission. This amendment resulted in the creation of three other Institutes in addition to the National Nuclear Research Institute (NNRI) formerly Kwame Nkrumah Nuclear Research Institute (KNNRI).

The three Institutes are the Radiation Protection Institute (RPI), Biotechnology and Nuclear Agriculture Research Institute (BNARI), Nuclear Power Institute (NPI), Ghana Space Science and Technology Institute (GSSTI) and Radiological and Medical Sciences Research Institute (RAMSRI).

The founding Act 204 of 1963 has been superseded by Act 588 of 2000 to make provision for GAEC to undertake commercialization of its research and development results.

The functions of the Commission as prescribed in Act, 588 of 2000 include the following:

- To make proposals to the Government for legislation in the field of nuclear radiation



and radioactive waste management;

- To advise the Government on questions relating to nuclear energy, science and technology;
- To establish, for the purpose of research and in furtherance of its functions, Institutes of the Commission and to exercise control over the boards of management of the Institute;
- To encourage and promote the commercialization of research and development results through its Institutes;
- To supervise the carrying out of all requirements designed to secure the safety and health of radiation workers and the environment;
- To engage in research and development activities, as well as in the publication and dissemination of research findings and other useful technical information;
- To oversee and facilitate the development of human resources in the fields of nuclear science and technology, and to promote the training of scientific, technical and non-scientific personnel of the Commission;
- To maintain relations with the International Atomic Energy Agency and other similar international and national organisations on matters of research and development of nuclear energy and nuclear technology; and
- To collaborate with Universities and Research Institutes for the purpose of conducting research into matters connected with the peaceful uses of nuclear energy and technology.

### 3.2.19 COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

The Council for Scientific and Industrial Research (CSIR) is one of the foremost national science and technology institutions in Ghana. It is mandated to carry out scientific and technological research for national development.

The Council was established in its present form by NLC Decree 293 of 10th October 1968 and re-established by CSIR Act 521 of 26th November, 1996. The Council, however, traces its ancestry to the erstwhile National Research Council (NRC), which was established by the Research Act 21 of August 1958, a little over a year after independence, to organize and co-ordinate scientific research in Ghana and provides the necessary platform for Ghana's accelerated development.

The CSIR is mandated to pursue, among others, the implementation of government policies on scientific research and development, coordinate research and development (R&D) activities of other science and technology (S&T) institutions nationwide and assist the government in the formulation of S&T policies for national development.

The CSIR is further required to commercialize appropriate technologies, in partnership with the private sector and other stakeholders, and encourage in the national interest, scientific and industrial research of importance for the development of agriculture, health, medicine, environment, technology and other service sectors of the economy.

The relevance of scientific research in assuring the success of implementation of the Convention cannot be overemphasized. The requirements of Article 19 underpin the importance of research and development in generating the output and information that will drive policy in the right direction for the success of the implementation of the Convention.



### 3.2.20 UNIVERSITIES

Ghana has several national and private universities, which have been undertaking teaching and research in several disciplines. The University of Ghana, Kwame Nkrumah University of Science and Technology, University of Cape Coast, University of Mines and Technology, University of Health and Allied Science, Central University, and Presbyterian University College, among several others in the country, run programmes and actively research on environment, chemistry, public health, geology, mining, petroleum, and waste management. There are many research reports from these universities on mercury in various environmental media including water, air, soil, sediment, wastes, and products such as creams and soaps.

#### 3.2.20.1 UNIVERSITY OF MINES AND TECHNOLOGY (UMaT)

The UMaT has had a long history that dates back to the early fifties. It went through a series of evolutions until 2004 when the University of Mines and Technology, Tarkwa Act 2004 (Act 677) was gazetted and it became law.

The Vision of UMaT is: to be a Centre of Excellence in Ghana and Africa for producing world class professionals in the fields of mining, petroleum, technology and related disciplines.

The Mission is to provide higher education in mining, petroleum, technology and related disciplines through effective teaching and learning; to promote knowledge through active research and dissemination of information and to offer professional services through extension activities to the mining and allied industries.

Within the context of the activities designed to achieve the objectives of the Convention, UMaT will play an important role in the areas of research, education and capacity development.

### 3.2.21 NON-GOVERNMENTAL ORGANISATIONS (CIVIL SOCIETY ORGANIZATIONS)

The role of NGOs and CSOs in the areas of advocacy, education, information and influencing policy and legislation cannot be underestimated. Both at the international and national levels, CSOs have played and continue to play a critical role in shaping the evolution of law and policy for sustainable development. It is in this context that this section takes a look at some CSOs that government must engage with in the implementation of our obligations under the Convention. Prominent among the CSOs involved in the development of the MIA report were the following;

#### 3.2.21.1 FRIENDS OF THE NATION (FON)

Friends of the Nation (FoN) is a socio-environmental advocacy NGO established in 1993 and registered in 1994. FoN operates in over 300 communities in coastal and mining regions in Ghana. FoN is a member of the Minamata Convention Implementation Committee in Ghana and it has a strong presence in almost all ASGM communities in the country. It is recognised and engaged by government on issues in ASGM. FoN is well-positioned to lead national campaigns in addressing working conditions of miners, supporting the implementation Minamata Convention and formalisation issues, expanding livelihood opportunities for miners and conducting anti-child labour awareness raising in Ghana and bring overall development to the ASGM sub-sector.

Currently, FoN in collaboration with the Natural Resources Defense Council is conducting a baseline assessment of mercury use in ASGM in Ghana to provide a comprehensive national analysis of ASGM sector to support the development and implementation of a road map to reduce mercury emissions and releases. This forms part of the National Action Plan of ASGM under the Minamata Convention on Mercury. FoN is also working with UMaT to develop and train miners on tailored-mercury free workflows.



Between April 2015- December 2017, as part of the initiative African Caribbean Pacific Multilateral Environmental Agreements Phase 2 (ACP/MEAs 2) project funded by the European Commission and implemented by the Food and Agriculture Organisation (FAO) of the United Nations via the European Environmental Bureau/Zero Mercury Working Group (EEB/ZMWG), which seeks to contribute to the preparation, ratification and implementation of the Minamata Convention on Mercury in Ghana. FoN developed background information on the ASGM sector in Ghana and co-developed Miner Consultation Guide for Engaging Artisanal and Small-Scale Gold Miners in the National Action Plan Development. It organised several Miner Consultations targeting over 500 stakeholders to collate their views and inputs for the NAP at the national and local level. The stakeholders include miners, local governments, NGOs, the media, private sector and government institutions such as the Environmental Protection Agency, Minerals Commission, Ghana Geological Survey Authority, Ministry of Trade and Industry and Ghana Health Service.

In collaboration with the International Institute of Environment and Development (IIED) (August 2015 – March 2016), Friends of the Nation, hosted a four-day multi-stakeholder, solutions-focused National Action Dialogue on ASGM in Ghana. A draft roadmap to a more sustainable, equitable and attractive business sector, with clear rights and responsibilities, emerged from proceedings. This roadmap has a practical focus on formalisation and covers geological prospecting and the identification of viable land for ASGM; streamlining licensing procedures for ASGM to obtain a license to mine; access to sustainable and formal sources of financing for ASGM; and stronger voice for ASGM operators, particularly women, in decision-making and policy.

There can be no effective implementation of the Convention without the active involvement of non-state actors like FoN which has a proven track record

of working with the small scale mining constituency that Article 7 deals with. Their involvement is research, capacity building and education and awareness means that they are critical partners in complementing the efforts of government in securing compliance to the provisions of the Convention.

### 3.2.21.2 ECOLOGICAL RESTORATIONS

Ecological Restorations (ER) carries out advocacy, raises awareness and builds capacity on environmental issues including the sound management of chemicals. Ecological Restorations (ER) carries out advocacy, raises awareness and builds capacity on environmental issues including the sound management of chemicals. The works of ER are widely circulated and published through the media outlets (print and electronic) thus reaching a wide network of stakeholders.

Notable amongst the works is: “raising of awareness on the effects of POPs amongst vegetable farmers in the Greater Accra Metropolis.” Other activities carried out by ER include awareness raising on Mercury (ASGM, Dental Amalgam and the Minamata Convention). ER also participated in the elimination of PCBs in Ghana as well as in the Nine Country study on Lead paint project in Ghana under IPEN/UNEP.

Currently ER is actively involved in the Medical Waste Project being implemented by four (4) African Countries (Ghana, Zambia, Tanzania and Madagascar).

### 3.2.21.3 INSTITUTE OF ENVIRONMENTAL COMPLIANCE AND SUSTAINABLE DEVELOPMENT (IECSD)

The Institute is involved in legal research, capacity development, development of legislation, environmental policy and compliance, ecological governance and sustainable development.

The IECSD is committed to the use of law, policy and



compliance as tools for securing sustainability in the ecological space both in Ghana and beyond through collaboration with national and international institutions. Pursuant to these objectives, the IECSD has been active in the development of environmental legislation in areas such as chemicals and hazardous wastes.

Through advocacy, education, publications and dissemination of relevant environmental information, the IECSD seeks to become one of the most credible outlets in the field of environmental compliance and issues of sustainable development

### 3.2.22 GHANA NATIONAL ASSOCIATION OF SMALL SCALE MINERS

#### MISSION

To promote effective, efficient and responsible artisanal scale mining for sustainable development

#### OBJECTIVES

- Building centers for research and development and vocational training that creates local capacity and innovate local technological, financial, and social solutions for ASM.
- Providing policy advise and recommendations to government and organizations locally and internationally
  1. Elimination of child labour in ASM;
  2. To promote the regularization and licensing for small scale mining;
  3. To reduce the use of mercury in recovering gold and hence reducing mercury pollution to the environment.

### 3.2.23 ZOOMLION GHANA LIMITED

Zoomlion Ghana Limited is the biggest waste management and environmental sanitation company not just in Ghana but across Africa. The Company was established under the Company's Act 1963 (Act 179), in January 2006.

The mission of the company is to be at the forefront of the environmental sanitation services industry by the introduction and utilization of simple but modern technologies and methods of waste management at affordable and competitive rates.

The company is involved in the full range of waste management services and is well resourced in terms of personnel, equipment and technical know-how. Among the varied services they offer is the management of landfill sites. A properly designed and managed landfill site will contribute greatly to the achievement of the objective of the Convention.

It is noted that the company also seeks to fill the huge gap in the critical mass of experts required in the environmental sanitation industry in Ghana and beyond. Pursuant to this agenda, it has established the African Institute for Sanitation and Waste Management to provide the sanitation industry with the trained and skilled man-power needed for effective delivery of environmental sanitation services.

### 3.2.24 ACCRA COMPOST AND RECYCLING PLANT (ACARP)

The Accra Compost and Recycling Plant is an integrated waste processing and recycling company established to receive, sort, process and recycle solid and liquid waste to produce organic compost for agronomic purposes in Ghana and the sub region. Since 2012, ACARP has been providing effective integrated processing, management and recycling of solid and liquid waste for economic and social good in an environmentally sustainable manner.

The absence of a culture of segregation of the waste in Ghana makes ACARP an important player in the management of the large amounts of waste generated by the growing urban and peri-urban population in Ghana. Their existence has reduced the amounts of garbage that would otherwise have been incinerated leading to mercury emissions and pollution of air, water and land.

According to the head of the laboratory at the plant, there are heavy metals in the compost including mercury but there is an acceptable limit that needs to be attained and the plant achieves that limit.



### 3.3 REGULATORY AND INSTITUTIONAL GAP ANALYSIS

This report also assessed the regulatory and institutional capacity gaps. In keeping with the standard developed for legislative measures, the assessment of institutional capacity is presented in

tabular form (See Table 3.1), where the key stakeholder for each article is identified and an assessment is made of the existing legislation for implementation of the corresponding Article, as well as opportunity for capacity enhancement that may be required.

Provision of the Minamata Convention	Relevant institution	Relevant legislation	Relevant provision	Implication for Ghana	Legal reform where necessary
<p>Article 3 on supply sources and trade: Not allow new primary mercury mining</p> <ul style="list-style-type: none"> <li>▪ Phase out existing primary mercury mining within 15 years</li> <li>▪ Prevent the import and use of mercury from primary mercury mining for artisanal and small-scale gold mining (ASGM)</li> <li>▪ In accordance with Article 3.5(b), restrict the import and use of excess mercury from decommissioning chlor-alkali plants, and require environmentally sound disposal</li> <li>▪ Obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/yr</li> <li>▪ Not allow the export of mercury unless the importing country provides written consent, the mercury is for an allowed use or environmentally sound storage, and all other conditions of Article 3.6 are met</li> <li>▪ Not allow the import of mercury without government consent, ensuring both the mercury source and proposed use are allowed under the Convention (and applicable domestic law)</li> </ul>	<p>Ministry of Trade and Industry (MOTI)</p> <p>Customs Division of the Ghana Revenue Authority</p>	<p>Mercury Act, 1989 (PNDC 217) and Environmental Protection Agency Act, 1994(Act 490) as well as existing trade policy.</p> <p>Ghana Revenue Authority Customs Guide, August 2011, Vol 1 issue 1,</p>	<p>Prohibits the importation of mercury without a license</p> <p>Restricts the importation of goods regulated by any law, except in accordance with that law;</p>	<p>The Chemicals Control and Management Centre of the Agency, is responsible for the regulation of all chemicals including Hg. The MOTI's role is restricted to the issuance of an import license under the Mercury Act. The EPA issues clearance to prospective importers, before they can take custody of their imports of mercury.</p> <p>Monitoring needs to be strengthened and capacities must be enhanced</p>	<p>Law is deficient in definition of mercury, monitoring of mercury once it enters Ghana's borders, it also does not incorporate the prior informed consent procedure.</p>
<p><b>Article 4 Mercury Added Products</b></p> <p>Not allow the manufacture, import, and export of products listed in Part I of Annex A, not otherwise excluded following the phase out date listed in the Annex</p> <ul style="list-style-type: none"> <li>▪Phase down the use of dental amalgam through two or more measures listed in Part II of Annex A</li> <li>▪Take measures to prevent the incorporation of products listed in Part I of Annex A (i.e., switches and relays, batteries) into larger, assembled products</li> <li>▪Discourage the manufacture and distribution of new mercury product</li> </ul>	<p>MOH/FDA and EPA Energy Commission</p>	<p>Public Health Act 2012 (Act 851).</p>	<p>Section 148 of this Act is relevant. It deals with guidelines and codes of practice in connection with food and drugs and with</p>	<p>The implementation of Act 971 and its LI 2250, should complement developments under the Public Health Act.</p>	

types		Ghana Standards Authority	Ghana Standards Authority Act	any other products or devices regulated by the Authority and affected persons are obliged to comply with the guidelines and codes of practice.  The Food and Drugs Authority may issue guidelines, inter alia, for the regulation of importation or exportation of food, drugs, herbal medicines, cosmetics, medical devices or household chemical substances in order to ensure compliance with that part of the law.	Under sections 3(b)(c) and (j) of NRCD 173, the Authority is to promote research in relation to specifications and to provide for the examination and testing of goods, commodities,	The existing standards being used by GSA require revision to include the acceptable levels of mercury in the
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	<p>1973 (NRCD 173)</p>	<p>the authority is ,to promote standards in public and industrial welfare, health and safety.? Consistent with this mandate, the Authority has developed two standards related to compact fluorescent lamps (CFLs) for general lighting purposes.</p> <p>GS:323:2003, Electrical Appliance and Accessories- Lighting systems-Self-Ballasted lamps for general lighting services- Performance Requirements and</p> <p>GS:324:2003, Electrical</p>	<p>processes and practices; to prohibit the sale or manufacture of goods in the national interest, and to assist government departments, local authorities and any other public bodies in the preparation of the specifications required by them.? Within this context, there needs to be close collaboration between the Authority and bodies like the FDA and EPA in the implementation of the Convention.</p>	<p>CFLs and new standards for High Pressure Mercury Vapor lamps (HPMV) for general lighting purposes developed.</p>
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		Appliance and Accessories- Lighting systems- Self-Ballasted lambs for general lighting services- Performance Requirements- Safety Requirement.			
	The processes described in this article and Annex B are not in use in Ghana	Sections 2, 12 and 13 of Act 490 and LI 1652	ACT 490 and LI 1652	EPA	<p><b>Article 5-Manufacturing processes</b></p> <ul style="list-style-type: none"> <li>▪ Not allow the use of mercury compounds in the manufacturing processes listed in Part I of Annex B</li> <li>▪ Restrict (as specified in the Annex) the use of mercury in the processes listed in Part I of Annex B</li> <li>▪ Not allow new facilities from using mercury in the processes listed in Annex B, except facilities using mercury catalysts to produce polyurethane</li> <li>▪ For facilities with processes listed in Annex B, identify and obtain information on mercury or mercury compound use; and control mercury emissions to air, and release to land and water</li> <li>▪ Discourage new uses of mercury in industrial processes</li> </ul>
The MELR has submitted a revised comprehensive OHS policy to cabinet for consideration. If approved, the policy will constitute the		Sections 2(d), (f), (h) and (l) of Act 490 are relevant.	Mercury Act Act 490 Factories, Offices and Shops Act, 1970, (Act 328)	MOT EPA GHS MELR GRA- Customs	<p><b>Article 7=ASGM</b></p> <p>Take measures to reduce, and where feasible, eliminate mercury and mercury compound use, emissions (to air), and releases (to land and water) associated with ASGM</p> <p>Establish coordinating mechanism and delineate agency roles for development/implementation of an ASGM National Action Plan (NAP)</p> <p>Set national objectives and mercury use reduction goals or targets consistent with the timely elimination of the worst practices and other use reduction efforts;</p> <p>Create baseline estimate of ASGM mercury use and practice</p>

<p>Strategies for involving stakeholders</p> <p>Strategies for providing information to miners and communities;</p> <p>Define and formalize or regulate ASGM consistent with the Convention</p> <p>Eliminate whole ore amalgamation, open burning of amalgam or processed amalgam, burning of amalgam in residential areas, and cyanide leaching of mercury-laden sediment, ore or tailings (the ,worst practices?)</p> <p>Set mercury use reduction goals or targets consistent with the timely elimination of the worst practices and other use reduction efforts</p> <p>Reduce mercury emissions, releases, and exposures associated with ASGM, and prevent mercury exposures of vulnerable populations (particularly women of childbearing age and children);</p> <p>Implement a public health strategy to address mercury exposures to ASGM miners and communities</p>	<p>Division</p> <p>Ministry of Information</p>	<p>GHS</p>	<p>Develop and implement a public health strategy.</p> <p>Provide information to miners and communities</p>	<p>basis for the development and enactment of a new legislation to bring the new law into compliance with the provisions of the Convention.</p> <p>No system currently exists to prevent the diversion of mercury once it enters Ghana and this must be addressed;</p> <p>GHS must develop a public health strategy;</p> <p>The MOI must develop information channels for sharing information with affected communities.</p> <p>The Mining and Minerals Policy</p>
		<p>Minerals and Mining Act, 2006 (Act 703); Minerals and Mining (Health, Safety and Technical Regulations, 2012 (LI 2182); Minerals and Mining Policy; Mercury Pollution Abatement Program (MPAP)</p>	<p>LI 2182 establishes environmental, safety, machinery and related guidelines for</p>	



<p>the MPAP include, awareness creation, supply and sale of retorts and mercury-free methods through the Mining Sector Support Program. The main objective was to develop a technology that would not entail the use of mercury in extracting gold from concentrates. University of Mines and Technology developed an equipment named 'Sika Bukya' in direct smelting method involving the use of fluxes (borax and soda ash) and other chemicals to extract gold without the use of mercury. A National Action Plan on ASGM is also being developed and shall recommend strategies to</p>					
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						manage mercury use in the ASGM sector.
<p><b>Article 8-Emissions</b>  Require best available techniques/best environmental practices (BAT/BEP) or associated emission limit values (ELVs) for new (as defined in Article 8.2(c)) sources listed in Annex D (waste incineration)  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  Require monitoring/reporting and otherwise establish a mercury emissions inventory for sources listed in Annex D</p>	EPA	Act 490, LI 1652 Act 917, LI 2250	Section 2 (f) (h) (i)	Emission limits exist but not the data. Actual measurements need to be undertaken but the capacity does not exist in the Agency for this assignment. This will need to be addressed Measures to control emissions to be detailed in a national action plan; There's a proposal to use coal fired power plants and during the consideration stage account must be taken of BAT and BEP as provided in Article 8(4) since they will be new sources.	Identification of point source categories. Establishment and maintenance of an	Amendment to existing law or a regulation under Act 490 may be necessary to
<p><b>Article 9-Releases</b>  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 ?</p>	EPA	Act 490 and LI 1652	Section 2(f)(h)(i)			

<p>Take one or more measures specified in Article 9.5 to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies ?</p>				<p>inventory of releases from relevant sources subject to the adoption of guidance by the COP on the methodology for preparing inventories of releases</p>	<p>sufficiently reflect the object of Article 9 and provide a basis for more effective implementation.</p>
<p><b>Article 10-Interim Storage</b> Take measures to ensure interim mercury storage is conducted in an environmentally sound manner, taking into account guidelines to be developed by the Conference of the Parties (COP)</p>	<p>EPA</p>	<p>Act 490 and LI 1652 Act 917 and LI 2250</p>	<p>Hazardous and Electronic Waste Control and Management Act 2016 (Act 917) and Hazardous Electronic and Other Wastes (Classification), Control and Management Regulations, 2016 (LI 2250); Section 2(d) of Act 490 Section 2(f) Section 2(h)</p>		
<p><b>Article 11- Mercury Wastes</b> Use a definition of mercury waste consistent with Article 11.2  <ul style="list-style-type: none"> <li>Take measures to manage mercury waste in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirements to be developed.</li> <li>Take measures to restrict mercury derived from the treatment or re-use of mercury waste to allowed uses under the Convention environmentally sound disposal</li> <li>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</li> </ul> </p>	<p>EPA</p>	<p>Hazardous and Electronic Waste Control and Management Act 2016 (Act 917) and Hazardous Electronic and Other Wastes (Classification), Control and Management Regulations, 2016 (LI 2250); Section 2(d) of Act 490 Section 2(f) Section 2(h)</p>	<p>An Act to provide for the control, management and disposal of hazardous wastes, electrical and electronic wastes and for related purposes. Among the category of waste streams sought to be dealt with under the Act are, mercury and mercury compounds</p>		



		<p>of the environment.? Section 2(f) mandates the Agency ,to issue environmental permits and pollution abatement notices for controlling the volume, types, constituents and effects of waste discharges, emissions, deposits or any other source of pollutants and of substances which are hazardous or potentially dangerous to the quality of the environment or a segment of the environment. ? Section 2(h) requires the Agency</p>			
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		, prescribe standards and guidelines relating to the pollution including the discharge of waste and the control of toxic substances.?			
	Development of appropriate strategies.		Act 490 and LI 1652	EPA	<p><b>Article 12- Contaminated Sites</b> Develop strategies for identifying and assessing sites contaminated by mercury or mercury compounds;</p> <p>If risk reduction activities are taken at contaminated sites, they are taken in an environmentally sound manner, incorporating risk assessment where appropriate.</p> <p><b>Article 13 - Financial Resource and Mechanism</b> Financial resources and mechanism Undertaking to provide within its capabilities, resources in respect of those national activities intended to implement the Convention</p>
	It is expected that the national implementation plan on mercury would be mainstreamed into the national budget planning process; Encourage other relevant agencies like the MOH/GHS to take mercury issues into account in their budget preparation Funding must also be sought through donor partners including bilateral, regional and	The MOF is the body responsible for budgeting so that government can meet its domestic and international financial obligations.		MOF and all partner institutions.	

<p><b>Article 16 - Health Aspects</b>  Promote the development and implementation of strategies to identify and protect populations at risk, which may include the adoption of guidelines;  Promote appropriate health-care services for prevention, treatment and care for populations affected by the exposure to mercury or mercury compounds; and  Promote the development and implementation of science-based educational and preventive programmes on occupational exposure to mercury and mercury compounds;  Promote prevention, treatment, and care services for affected populations;  Strengthen institutional and professional capacities for addressing health risks associated with mercury exposure.</p>	MOH/GHS EPA Ministry of Sanitation and Water Resources	Ghana Health Service Act; Public Health Act; Factories, Offices and Shops Act 1970 (Act 328); Health care waste management policy for Health sector Health care waste management guidelines for Health sector Revised OHS policy  The MELRs has submitted a revised OHS policy to government for consideration	Public health regulations being currently developed will have to provide GHS/MOH more mandate for health protection.	multilateral. Establish the appropriate linkages with the SDGs  An HCWM Guideline has been updated to incorporate the problem of mercury waste coming from obsolete and damaged blood pressure apparatus and thermometers;  There is currently a GEF/UNDP funded project on: 'Reducing UPOPS and elimination of mercury waste from health care management.' There are only five beneficiary facilities under this project and this is clearly inadequate and need to be expanded.  The MOH has developed an OHS Policy	A new law on occupational health and safety must take into account the obligations of the convention in respect of this and related articles.
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	<p>and approval. If approved, it will be the basis for the development and adoption of a new Act on occupational health and safety incorporating modern concepts and trends in OHS</p>		<p>EPA MOI CSOs Research institutions such as the universities and CSIR</p>	<p><b>Article 17 – Information Exchange</b> Collect and disseminate information on annual quantities of mercury and mercury compounds emitted, released or disposed and other information specified in Article 18;  Share information on the health and safety of humans and the environment as non-confidential in accordance with Article 17.5;  Report to the COP on progress in implementing Convention obligations under Article 21</p>
	<p>Act 490</p>		<p>EPA Ministry of Information</p>	<p><b>Article 18-Public Information, Awareness and Education</b>  Each party to facilitate exchange of information on:  Mercury and mercury compounds; The reduction or elimination of the production or trade, emissions and releases of mercury and mercury compounds;  Technically viable and economic alternatives including information on the health and environmental risks and economic and social costs and benefits</p>
	<p>Act 490</p>	<p>Section 2(m) of Act 490 requires the Agency ,to initiate and pursue formal and non-formal education program for the creation of</p>	<p>Public Affairs (PA) and Education Department of EPA work in close collaboration with other departments such as education, mining and chemicals, information services</p>	<p>Collaboration with and engagement of actors in the media space as well as institutions both at national and international level. EPA will play a coordinating role</p>
	<p>Act 490</p>	<p>Section 2(m) of Act 490 requires the Agency ,to initiate and pursue formal and non-formal education program for the creation of</p>	<p>Public Affairs (PA) and Education Department of EPA work in close collaboration with other departments such as education, mining and chemicals, information services</p>	<p>The EPA, MOI and relevant NGOs are already engaged in information dissemination activities which can be reinforced in the area of the convention and what it seeks to achieve.  The PA department will now have to incorporate issues of mercury into its program of work. Stakeholder engagement and capacity development in</p>

<p>of such alternatives. health impacts associated with exposure to mercury and mercury compounds in close cooperation with WHO and other relevant organizations.</p>			<p>public awareness of the environment and its importance to the economic and social life of the country.?</p>	<p>department of Ministry of Information, the media and other fora in sharing information and creating awareness.</p>	<p>this area including communication research will be required.</p>
<p><b>Article 19-Research, Development and Monitoring</b> Parties shall endeavor to cooperate to develop and improve, taking into account their respective circumstances and capabilities: (a) inventories of use, consumption, and anthropogenic emissions to air and releases to water and land of mercury and mercury compounds; (b) Modelling and geographically representative monitoring of levels of mercury and mercury compounds in vulnerable populations and in environmental media, including biotic media such as fish, marine mammals, sea turtles and birds, as well as collaboration in the collection and exchange of relevant and appropriate samples; (c) Assessments of the impact of mercury and mercury compounds on human health and the environment, in addition to social, economic and cultural impacts, particularly in respect of vulnerable populations;? (d) Harmonized methodologies for the activities undertaken under subparagraphs (a), (b) and (c); (e) Information on the environmental cycle, transport (including long-range transport and deposition), transformation and fate of mercury and mercury compounds in a range of ecosystems, taking appropriate account of the distinction between anthropogenic and natural emissions and releases of mercury and of remobilization of mercury from historic</p>	<p>EPA and partner research institutions including the universities</p>	<p>Act 490</p>	<p>Section 2(k) of Act 490 requires the Agency ,to conduct investigations into environmental issues and advise the Minister on these issues.? Section 2(l) requires the Agency ,promote studies, research, survey and analyses for the improvement and improvement of the</p>	<p>A substantial amount special training and capacity development will be required both in the Agency and collaborating institutions for them to be able to satisfactorily execute, the requirements of this article.  Some capacities exist in terms of equipment and human resources across the country within the universities, research institutions and some agencies such as the EPA.</p>	

<p>deposition</p> <p>(f) Information on commerce and trade in mercury and mercury compounds and mercury-added products; and? (g) Information and research on the technical and economic availability of mercury- free products and processes and on best available techniques and best environmental practices to reduce and monitor emissions and releases of mercury and mercury compounds</p>			<p>environment and maintenance of sound ecological</p> <p>Requires environmental assessment as a condition for both new and existing projects.</p> <p>Impacts on human health and the environment are part of the areas that must be addressed in the assessment process.</p>		
<p><b>Article 21-Reporting</b></p> <p>Obligations to report on measures each Party has taken to implement the provisions of the Convention. Including reporting information on Articles 3, 5, 7, 8 and 9 of the Convention</p>	<p>EPA</p>			<p>EPA is the focal point for the Basel, POPs and PICs conventions. It has been responsible for meeting the reporting obligations under these Conventions</p> <p>The Agency will continue to play this role under the Minamata Convention.</p>	



### 3.4 IMPLICATIONS OF THE ASSESSMENT RESULTS FOR GHANA AS A PARTY TO THE MINAMATA CONVENTION

It is important to state from the outset that a careful review and assessment of Ghana's legal framework on chemical-related legislation, reveals that there is no single law that comprehensively covers all the provisions of the Convention. It must be added however, that some of the existing laws, including some very recent ones like Act, 917 of 2016 and L.I. 2250 address some of the challenges posed by mercury that the Convention seeks to address. In effect, Ghana is not yet fully compliant with the Convention.

Ghana has a Mercury Act (PNDCL 217). That was adopted in 1989 under a military regime that ruled by decree in the absence of a Parliamentary system of governance. Notwithstanding its title however, its provisions, does not address the objective of the Convention. It has direct relevance to Article 3 to the extent that it provides a regulatory regime for mercury imports through a licensing system. It is however silent on export and no law specifically prohibits it. It is also silent on how to track the use of mercury once it is within Ghana

Under Article 3, mercury mining is prohibited. While Ghana does not mine mercury, there is no legislation that proscribes its mining at a future date. That is a legislative gap that needs to be addressed by an enactment that clearly prohibits this activity.

Another defect is the definition of mercury in the Mercury Act of 1989 which falls short of that in the Minamata Convention.

It is noted however that, section 10 of Act 490 establishes a Hazardous Chemicals Committee. The Committee is a subsidiary body of the Board of the Agency with a mandate, among others, to:

“monitor the use of hazardous chemicals by collecting information on the importation, exportation, manufacture, distribution, sale, use, and disposal of those chemicals;

advise the Board and the Executive Director on the regulation and management of hazardous chemicals.”

While this provision in Act 490 may be construed as providing a cure for the defect in Mercury Act of 1989 of PNDCL 217, that is not quite the case. As currently couched, there are no enforcement provisions. It is not clear what is sought to be achieved by monitoring through the collection of information on the life-cycle of the chemicals involved. With no definition of chemicals, one is not sure about the scope of chemicals covered by this mandate. The need for national legislation that gives clarity and meets the obligations under the Convention remains and must be addressed.

Section 62 of Act 490 deals with regulations and s62(1)(d) regulations may be made covering, “the manufacture, importation, use, collection, storage, recycling, recovery or disposal of substances which may be hazardous to the environment.”

No such regulations have been made and yet the scope of this section is broad enough to cover specific provisions of the Convention.

Article 4 deals with mercury-added products listed in Part 1 of Annex A. Ghana imports but does not manufacture or export mercury-added products. The mandate of the FDA is contained in the Public Health Act, 2012 (Act 851). The prohibition in section 111 of the Act covers cosmetics and medical devices. The FDA may issue guidelines among others, for, “the regulation of importation or exportation of food, drugs, herbal medicines, cosmetics, medicinal devices or household chemical substances in order to ensure compliance with this Part.” Failure to comply will lead to payment of an administrative penalty. Failure to pay is criminalized with accompanying penalties. Consistent with the above powers, the FDA issued



Guidelines for importation of cosmetics and household chemical substances (FDA/MCH/CHC/GL-ICH/2013/01). Section 6.4 deals with banned products and (b)(4) bans all mercury based products.

Additionally, the Customs Division of the GRA has guidelines that specifically prohibit the importation of cosmetics containing mercury. An effective enforcement regime by the customs officials at the port of entry will make the work of the FDA easier.

No existing law incorporates all the prohibitions under Article 4 of the Convention and this must be addressed by the introduction of new legislation which consolidate existing laws on mercury including provisions under the Minamata Convention.

Under Article 5, the focus is on manufacturing processes that use mercury or mercury compounds. Environmental concerns within the manufacturing sector, has been dealt with under Act 490 with the Agency leading the process of environmental governance within industry and the manufacturing sectors. Through the combination of sections 2, 12 and 13 of IAct 490 and L.I. 1652, the Agency can ensure compliance with Article 5.

Article 6 deals with exemptions available to a party upon request. Consequently, Ghana has registered for exemptions from the phase-out dates for Annexes A (Mercury added products) and B (manufacturing processes in which mercury or mercury compounds are used). The exemption was necessitated by lack of requisite data, information, technical and financial capabilities to comply with the phase-out dates. In that respect, some urgent actions as indicated in Chapter 6 (Implementation plan and Priority Actions) of this report would enable the country to be compliant with the obligations under the convention.

Article 7 on artisanal and small-scale gold mining is of particular relevance to Ghana. As earlier stated, ASGM operations contribute significantly to the economy of Ghana. Consequently, Ghana is

developing a National Action Plan for ASGM as provided for in Annex C.

It is hoped that the active involvement in and engagement of non-state actors in the preparation of the NAP will result in changes that will bring Ghana into full compliance with Article 7

Articles 8 and 9 on emissions and releases respectively, are also covered by Act 490 with the Agency leading the process of compliance. Act 490 and L.I. 1652 and draft standards have been to help regulate and manage emissions and releases. Sufficient data does not exist in terms of measurements and more work needs to be done to enable the Agency to effectively deliver on its mandate in these areas. It will require some retooling and capacity enhancement.

Article 10 is of a major issue in Ghana as far as mercury use in the ASGM sector is concerned. Interim storage of mercury would be done in an environmentally sound manner in accordance with guidelines to be adopted by the Conference of Parties.

Article 11 is on mercury wastes, and until 2016 unregulated under any specific laws. The enactment Act 917 and L.I. 2250 have altered the position. These laws were adopted to give effect to Ghana's obligations under the Basel and Stockholm Conventions and their existence has brought Ghana into compliance with Article 11 of the Convention.

Under Article 12 on contaminated sites Ghana will develop appropriate strategies in line with the guidance to be developed and adopted by the COP.

Articles 13 and 14 do not require legislation as financial resources, capacity building, technical assistance and technology transfer are required to complement activities for the implementation of the convention. During the consultation process in the preparation of this report, a number of institutions called for logistical support, training and capacity



development. Fortunately, there are currently institutions in Ghana that can deliver some of the capacity building services. As a country, Ghana must also take advantage of the opportunities provided under these Articles and access the required assistance to effectively implement its obligations.

The Occupational Health and Environment Unit of the Ghana Health Service will play a key role in the implementation of Article 16. The dangers associated with the misuse of mercury as well as emissions and releases are of concern. According to the Ghana Health Service, some work is already in progress to address mercury releases and emissions from the health sector.

Information exchange (Article 17) and public information, awareness and education (Article 18) are regular features in the work of the EPA. However, the EPA will need to improve its knowledge base to be able to provide the public with the appropriate information as well as create awareness and educate. The ISD of the Ministry of Information will be an important partner in this enterprise.

Relevant provisions of Act 490 and LI 1652 covers Article 19. Additional work on research, development and monitoring will have to be done to allow for greater effectiveness under this Article. Under Article 20, the EPA will deliver this mandate to the Secretariat.



# Chapter Four

## IDENTIFICATION OF POPULATIONS AT RISKS AND GENDER DIMENSIONS

### 4.1 INTRODUCTION

This chapter discusses populations that are risk to mercury exposure, and how such exposure affects humans differently, particularly vulnerable populations as well as the environment. The chapter concludes with the implication of the discussions for Ghana as a Party to the Minamata Convention.

### 4.2 IDENTIFICATION OF POPULATIONS AT RISK

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

The other subpopulation that may be at greater risk to mercury toxicity are those exposed to higher levels of methylmercury due to fish and seafood consumption (such as recreational anglers and subsistence fishers, as well as those who regularly eat large amounts of fish and other seafood). Besides fish and shellfish, exposure can also be significant in populations consuming meat (muscle and organs) from marine mammals (such as seals and whales).

Individuals with dental amalgams generally have greater exposure to elemental mercury than those who do not. Other populations with potential for higher than average exposure are workers with high occupational exposure, and individuals who use

various consumer products that contain mercury (such as some skin lightening creams and soaps), traditional ethnic medicines containing mercury, or use mercury for cultural and religious purposes.

Some of the symptoms of acute mercury exposure in adults are chest pain, dyspnea, cough, hemoptysis, pneumonia, massive and rapid pulmonary fibrosis, hypertension and palpitation. The effects of mercury exposure in pregnant women and children are same as in adults, but are much more severe during brain development, and it start as soon as conception (hence the danger to pregnant women). The effects also manifest themselves more quickly in children than in adults and may be irreversible for chronic exposure.

As discussed in Chapter Two, the major source of mercury input into the environment was gold extraction with mercury amalgamation- from concentrate 45,150.0 kg Hg/y, followed by primary metal production (excluding gold production by amalgamation) that accounted for mercury emissions and releases of an estimated quantity of 19,681.0 kg Hg/y, followed by use and disposal of other products of 11,989.0 kg Hg/y, and then waste incineration and open waste burning of 9,311 kg hg/y respectively.

Based on the information on sources of mercury releases, the populations identified to be at risk to mercury exposure in Ghana are those living in or near communities where gold mining activities take place (both large-scale and ASGM); recyclers of electrical and electronic waste and general waste pickers; dental workers and people living in areas where dental amalgam fillings are disposed; people living near cemeteries; and consumers of fish.

#### 4.2.1 POPULATIONS LIVING IN GOLD MINING AREAS

Mercury is naturally present in gold ores in varying amounts. Where mercury is present, it can be released into air through mining and processing of these ores, causing possible human and environmental impacts.



According to the inventory results about 90% of mercury from large-scale mining, is released to land. Mercury is most likely to be emitted and released during the processing of the ores - either by roasting the sulphide ores (when it will mostly be emitted to air) or by heap leaching, carbon in pulp etc. In Ghana, processing of gold especially for surface mining operations is through heap leaching. Mercury releases and emissions releases and emissions from the large-

scale gold mining industry affect two main groups of people; those working in the mines and those living in nearby communities. In Ghana, it is estimated that 11, 620 people are employed in the large-scale mining of which 90 percent are in the gold mining sector (Ghana Chamber of Mines 2016). Large scale gold mining occurs in 10 districts covering about over 100 communities. The total number of people at risk to mercury exposure from large-scale gold mining is estimated to be over 500,000.



ASGM miners are highly exposed to mercury

From the inventory results, gold extraction with mercury amalgamation from concentrate is 45,150kgHg/y of which 72% are released to air. As mentioned earlier in Chapter two, amalgamation is the preferred gold recovery method employed by almost all artisanal and small-scale gold miners in Ghana because it is a very simple, easy-to-use, technique and is inexpensive. As earlier mentioned, ASGM is largely carried out in rural communities in 8 out of 10 regions of Ghana. An estimated 1million people are engaged in the operations of which about 40 to 50 percent are women (Hilson, 2001). It is significant to note that these women are often

accompanied by their children, some of whom also participate in the work. In ASGM operations, exposure to mercury is mainly through amalgamation. At mine sites, amalgamation is mostly done by men but there are a few cases where women are also involved in the process. The major route of exposure for these workers is via inhalation of mercury vapour released through heating of the amalgam to recover the gold. Mercury may also be absorbed directly through the skin as the amalgamation process is typically done by hand without the use of appropriate personal protective equipment. Another form of direct mercury exposure is via the oral route where



elemental mercury is wrapped in a cloth or handkerchief into the mouth to squeeze out the excess mercury. Apart from the mine site, amalgamation may be carried out in homes on cooking stoves and using kitchen utensils where women and children are particularly at high risk of exposure.

Mercury being used by an ASGM miner in a household utensil



In addition, mercury lost to the tailings or discarded as waste may be released into land and water bodies. This mercury is likely to be transformed to methylmercury which may accumulate in aquatic organisms (notably fish), wildlife and also contaminate land. As a result, communities that depend on these contaminated river bodies and lands may be exposed to high levels of mercury and mercury compounds through the food chain.

Land and water bodies have been highly polluted by illegal mining activities of which mercury is used



Mercury is naturally present in gold ores in varying amounts. Where mercury is present, it can be released into air through mining and processing of these ores, causing possible human and environmental impacts. Mercury is most likely to be emitted and released during the processing of the ores - either by roasting the sulphide ores (when it will mostly be emitted to air) or by heap leaching, carbon in pulp etc. In Ghana, processing of gold especially for surface mining operations is through heap leaching. According to the inventory results 19,681.0 kg Hg/yr released from large-scale mining of which 90% is released to land and 4% and 2% released to air and water respectively. Consequently, two groups of people are vulnerable; those working in the mines and those living in nearby communities. In Ghana, it is estimated that 11,620 people are employed in the large-scale mining of which 90 percent are in the gold mining sector (Ghana Chamber of Mines 2016). Large scale gold mining occurs in 6 regions covering over 100 communities. The total number of people at risk to mercury exposure from large-scale gold mining is estimated to be over 500,000.

#### 4.2.2 RECYCLERS OF ELECTRICAL AND ELECTRONIC WASTE AND GENERAL WASTE PICKERS

Mercury can enter the environment through the improper disposal of electrical and electronic waste (e-waste) such as fluorescent tubes, tilt switches (switches in thermostats and other mechanical devices), older computers and batteries. Waste pickers collect such e-wastes and send them to recyclers, together with other wastes for further processing. Both the waste pickers and recyclers are at risk to mercury exposure. E-waste pickers and recyclers can develop respiratory illness, developmental and behavioral disorders, damaged immune, nervous and blood systems, kidney damage, impaired brain development, mental disability from mercury poisoning, and eventually cancer.

Mercury releases from e-waste to air, land and water may also lead to serious environmental consequences. Such releases may eventually lead to



pollution of aquatic organisms, wildlife and eventually, humans. Ghana has one of the biggest e-waste dump sites (Agbogbloshie) in the world, – situated on the banks of the Korle Lagoon in Accra. This dump site which covers an estimated land mass of 0.4 km<sup>2</sup> is home to 79,684 individuals (Environmental Justice Atlas).

At Agbogbloshie, e-waste collectors and recyclers (including children) salvage copper, aluminium and other metals from electronic equipment like computers and televisions. These equipment are either illegally dumped or legally imported in the form of second hand electronic and electrical equipment (EEE) from the UK, US and EU. More generally, Ghana's e-waste activities sustain the livelihoods of at least 200,000 people nationwide and generate US\$105–268 million annually (Environmental Justice Atlas).

At Agbogbloshie and other e-waste dump sites, children and young men spend time dismantling, recovering, weighing and reselling parts and metals extracted from scrapped devices and from heaps of electronic waste. They smash devices to get to the metals, especially copper. These children and young men are exposed to injuries, such as burns, untreated wounds, eye damage, lung and back problems, chronic nausea, anorexia, debilitating headaches and respiratory problems.



A section of the Agbogbloshie e-waste dumpsite with scavengers actively working

Laboratory investigations by Greenpeace showed that water and soil from Agbogbloshie e-waste site contained high concentrations of toxics including mercury at levels a hundred times more than the allowable amount (Greenpeace, 2008).

The Agbogbloshie informal settlement, e-waste site, and food markets have all grown in size and density over the last decade (until the demolition of June 2015 when the AMA destroyed several hundred informal structures), leaving the vicinity choked with remnants of old electronic goods, dust, and ashes—as well as smashed timber and metals from slum demolitions. Waste left in fields and nearby water bodies is ingested by animals and marine life, thus creating entry points for toxics into non-human ecological systems. The proximity to food markets and residences to this site heightens the degree of exposure for humans and the environment (Duam et al, 2017).

Section of a food market behind the e-waste dump site at Agbogbloshie



#### 4.2.3 EXPOSURE FROM DENTAL AMALGAM

Dental amalgam is commonly used in dentistry. Waste amalgam, either remaining from preparation or removed from patients may be discarded and enter the general solid waste stream and waste water systems, posing potential threats to humans and the environment. According to the inventory calculations



in Chapter two, dental mercury amalgam fillings source contributed to 107 kg Hg/y of which 44% is released to water and 20% to general waste. Populations vulnerable to the mercury emissions and releases from dental amalgam are Dental workers, patients and people living in areas where dental amalgam fillings are disposed.

As reported in Chapter 2 of this report there were 148 dentists in Ghana 2009. The Ghana Medical and Dental Council indicated, majority of middle level people who normally repair decaying teeth and fill a cavity are unaware about dangers posed by mercury amalgam fillings.

#### 4.2.4 CONSUMERS OF FISH

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

Ghana is among the highest consumers of fish in the world with an estimated annual per capita consumption of 23-25 kg. The fishing industry employs 10% of the population and contributes to 60% of animal protein (MoFAD). As regards fish consumption, both males and females generally eat the same amounts of fish. However, the adverse health impacts due to exposure of mercury are higher in children, pregnant women and women in child-bearing years as the developing organ systems (such as the foetal nervous system) are the most sensitive to toxic effects of mercury. Recent studies by Downer et al. (2017) showed that there may be increased risk for cardiovascular disease in adults, which are either sensitive to methylmercury or those having elevated mercury levels. It is noteworthy that men are more prone to cardiovascular disease than women.

### 4.3 STUDIES OF MERCURY LEVELS IN HUMANS AND THE ENVIRONMENT IN GHANA

Drawing from the potential impact of mercury on vulnerable populations in Ghana some studies have been carried out to ascertain the level of mercury in humans and the environment. Below is a summary of such studies:

- Hogarh et al. (2016) evaluated the contamination from arsenic (As), cadmium (Cd), copper (Cu), mercury (Hg) and lead (Pb) in sediment cores collected from Lake Amponsah in Bibiani District, a historical gold mining town in Ghana. Sediment cores were sampled to a depth of 30 cm. The Lake was found to be undergoing sedimentation at an average rate of 1.76 cm/y. There was marginal decline in mercury concentrations over the past two decades (from the 1990s to 2010s), while the other metals showed relatively increasing trends. It was concluded that mercury legislation in Ghana should be enforced to the letter as it has shown good signs of reducing environmental contamination from the metal.
- Kwaansa-Ansah et al (2010) assessed total mercury concentrations in human hair and urine samples to ascertain the extent of environmental and occupational mercury exposure in Dunkwa-On-Offin, a small-scale gold mining area of the central west region of Ghana. In all ninety-four (94) hair and urine samples comprising forty (40) small-scale miners and fifty-four (54) farmers were collected and analyzed for their total mercury levels using the cold vapour atomic absorption spectrometry. The hair total mercury concentrations ranged from 0.63 to 7.19 ug/g with a mean of  $2.35 \pm 1.58$  ug/g for the farmers and 0.57–6.07 ug/g with a mean of  $2.14 \pm 1.53$  ug/g for the small-scale



gold miners. There was no significant correlation between the total mercury concentration and the average weekly fish diet. The total mercury concentrations in urine of the miners were higher than those of the farmers and ranged from 0.32 to 3.62 ug/L with a mean of  $1.23 \pm 0.86$  ug/L. The urine concentrations of farmers ranged from 0.075 to 2.31 ug/L with a mean of  $0.69 \pm 0.39$  ug/L. Although the results indicated elevated internal dose of mercury the current levels of exposures do not appear to pose a significant health threat to the people.

- S. O. B. Oppong et al (2010) assessed total Mercury (Hg) concentrations in soil, river sediments and six (6) species of fish from the River Pra Basin in southwestern Ghana by Cold Vapour Atomic Absorption Spectrometry. Mercury concentration (Igg-1) ranged from 0.042 to 0.145 for soil: from 0.390 to 0.707 for sediments and from 0.001 to 0.370 for fish. All the fish samples had Hg concentration below the World Health Organisation (WHO) permissible limit of 0.5 Igg-1 whereas all the sediment samples had levels higher than the US-EPA value of 0.2 Igg-1. The results obtained from this study showed that fish from River Pra Basin are unlikely to constitute any significant mercury exposure to the public through consumption. It was concluded that no apparent trend of increasing mercury concentration along the main river as it flows downward toward the sea was observed.

combined with the removal of mercury-added products from the marketplace, is likely to be the most effective measure to prevent exposure to the mercury contained in such products. Where products remain in use, in particular within the healthcare sector, training in safe handling of mercury-containing devices to prevent breakages and spillages; information sharing on exposure risks, and revision of procurement policies to favour mercury-free alternatives are of utmost importance. With regard to dental amalgam, the measures set out in Part II of Annex A form the basis of a phase-down initiative.

Article 7 (Artisanal and small-scale gold mining): Ghana is developing a National Action Plan on ASGM which will include a public health strategy covering health data, training for health-care workers and awareness raising through health facilities. The Action plan will also include strategies to prevent the exposure to mercury of vulnerable populations particularly children and women of child-bearing age, especially pregnant women, in communities engaged in, or effected by ASGM.

Article 16 (Health aspects): The inventory highlights the potential exposure to mercury of a number of population groups including those exposed as a result of ASGM activities, those engaged in informal activities dealing with waste, and those handling mercury-containing products, including amalgam, in the health sector. Ghana will consider strategies and programmes to identify and protect these and other populations at risk pursuant to paragraph 1 of article 16.

#### 4.4 IMPLICATIONS OF THE ASSESSMENT RESULTS FOR GHANA AS A PARTY TO THE MINAMATA CONVENTION

Article 4 (Mercury-added products): Promotion of mercury-free alternative products, where possible

# Chapter Five



## PUBLIC AWARENESS, TRAINING AND EDUCATION FOR TARGET GROUPS AND PROFESSIONALS

### INTRODUCTION

This chapter assesses the level of awareness and understanding of workers with higher risks of exposure to mercury as well as the general public. It also provides information on existing training and education opportunities on the use of mercury-free alternatives, among others. Recommendations for future trainings for specific target groups and professionals such as miners, health workers, traditional authorities, NGOs, waste managers and governmental bodies with respect to specific articles in the Convention are also provided.

### 5.1 LEVEL OF AWARENESS OF WORKERS AND THE GENERAL PUBLIC

Generally, there is low awareness among the Ghanaian public on mercury and its impact on human health and the environment. In recent times, there

has been an increased awareness among miners and health workers as a result of sensitization, training and education by various institutions/organizations including government, mining companies and NGOs.

In the ASGM sector for instance, there are existing programmes aimed at educating miners on the harmful effects of mercury and mercury compounds and the use of mercury-free technologies in the extraction of gold. In the health sector on the other hand, awareness is being created among staff in selected health facilities in a pilot project to shift towards the use of mercury free devices.

There is therefore the need to intensify and expand the scope of the awareness raising and training programmes to cover all health workers, miners and the general public.

Table 5.1 below provide details on existing programmes for specific target groups.

Table 5.1: Existing awareness, training programmes for specific target groups.

No.	Name of training programmes	Description of Programmes	Institutions involved	Target groups
1	Training of miners on good mining practices	This is part of the 5-year Multi-Sectoral Mining Integrated Project (MMIP) and entails the provision of technical training on good practices in surveying, prospecting, mining, mineral extraction, environmental and safety management for small scale miners. This programme which is funded by the Government of Ghana began in August 2017 and has so far trained 400 miners from nine mining districts in 2017. 1,000 more miners are expected to be trained in 2018	Ministry of Lands and Natural Resources; and George Grant University of Mines and Technology, Tarkwa	Small-scale miners; Minerals Commission; EPA; and Small-scale mining district committees



2	Awareness and training on Environmental Health & Safety aspects of Mining	Training of small-scale miners in selected mining communities on good practices in mining with focus on environmental, health and safety issues.	Friends of the Nation, Ghana; GIMPA; George Grant University of Mines, Tarkwa; Presbyterian University College, Akropong; Accra School of Hygiene,	Small-scale miners; media; NGOs, EPA; Minerals Commission.
3	National Action Plan project on ASGM under the Minamata Convention	Under the NAP, recommended activities will likely include awareness creation on the adverse effects of mercury on human health and the environment, the Minamata Convention, and Mercury-free ASGM technologies.	EPA, GHS, UNIDO, Friends of the Nation, NRDC, WHO European Environmental Bureau, Zero Mercury Working Group	Miners; traditional authorities; civil society organizations; local government; health workers; mining communities; and the general public;
4	Awareness raising and training on Mercury Phase-out in the health sector	UNDP and the Ministry of Health's health-care waste management project is supporting seven health facilities in mercury phase out activities and awareness raising on the Minamata Convention	UNDP, Ministry of Health, Ghana Health Service and EPA	Health workers, Government institutions (EPA, MOH, MLGRD, GHS, Schools of Hygiene) and the General public
5	Training on baseline Inventory on mercury use in ASGM	As part of the NAP development, this training entailed methods for creating an inventory of quantities of mercury use and practices employed in the ASGM sector. The assessment method involves physical measurements and the collection of primary and secondary data in selected mining districts to estimate the amount of mercury used in ASGM in Ghana.	UNIDO, Natural Resources Defense Council, USA, Friends of the Nation, Ghana, EPA	Miners, NGOs, Minerals Commission, EPA.



6	Inventory of Mercury-containing devices in the Health Sector	The UNDP/MoH project conducted an inventory of mercury containing devices (BP apparatus and thermometers) within 7 health facilities. This involved an assessment of the number of mercury containing devices (damaged and in use) in these facilities. Data gathered were used in estimating the level of mercury use and possible mercury releases in the environment from these facilities.	UNDP, Ministry of Health, the Ghana Health Service and EPA	Health workers, Government institutions (EPA, MOH, MLGRD, GHS, Schools of Hygiene) and the General public
7	Awareness raising to improve working conditions in small-scale mining operations	The ILO CARING Gold programme targets miners to raise awareness on improved working conditions. It focuses on the impact of mercury on human health and the environment in six communities in the Western, Eastern and Ashanti Regions	ILO, Friends of the Nation, Solidaridad, Ghana National Association of Small-scale Miners,	Small-scale miners, EPA, Minerals Commission, NGOs
8	Developing tailored Mercury-free workflows for ASGM operations	This project involves the training of miners on the development of targeted, mercury-free process work flows based on the metallurgy and mineralogy of different ore bodies in Ghana's mining regions.	US Embassy, Friends of the Nation, George Grant University of Mines and Technology, Minerals Commission, EPA, Ghana National Association of Small-scale miners	Small-scale miners, Minerals Commission



9	Creating Mercury-free environment in the health sector.	Mercury-free work environment in the health sector is being created through the replacement of mercury containing devices with mercury-free alternatives. So far, about 400 mercury-free thermometers and sphygmomanometers have been supplied to 7 health facilities to replace mercury-containing ones.	UNDP, Ministry of Health, Ghana Health Service, EPA	Health workers, Government institutions (EPA, MOH, MLGRD, GHS, Schools of Hygiene)
10	Environmental Health and Pollution Management Program in Africa	<ul style="list-style-type: none"> <li>• Strengthen institutional systems and provide capacity building for national bodies to manage the ASGM sector.</li> <li>• Strengthen the policy requirements targeted at the ASGM sector.</li> <li>• Demonstrate, using cost-effective and environmentally sound technologies to improve selected abandoned mines.</li> </ul>	World Bank, EPA, Minerals Commission	ASGM workers and communities, Government institutions (EPA, Minerals Commission, Customs Division)



## 5.2 IMPLICATIONS OF THE ASSESSMENT TO GHANA AS A PARTY TO THE CONVENTION

Based on the assessment, the level of awareness of workers, health professionals and the general public were found to be low. Existing training programmes were also found to be inadequate. Under the circumstances, Ghana would need support and partnerships to meet its obligation under the convention.

The training needs of relevant institutions and organizations in relation to their capacity to implement specific articles of the convention have been identified in Table 5.2. Recommendations for further institutional strengthening and capacity building for national institutions with regulatory and enforcement roles have also been identified.

With regards to the ASGM sector which has been

identified as a significant source of mercury emissions and releases in Ghana, the National Action Plan on ASGM is expected to provide strategies to significantly reduce and where feasible eliminate the use of mercury as required in Article 7 of the convention. The strategies will include measures to formalize of the sector, explore the use of mercury-free techniques and raise awareness among miners and people living in mining communities especially, vulnerable groups such as women and children.

## 5.3 RECOMMENDED AWARENESS AND TRAINING NEEDS FOR IDENTIFIED TARGET GROUPS

Table 5.2 below provides a list of identified institutions and recommended areas for training, awareness and capacity building for the implementation of the Minamata Convention.



Table 5.2 Target groups and recommended awareness and training needs

No	Target group	Specific areas of training	Related articles
1	Ministry responsible for the Environment, the Environmental Protection Agency, Ghana Atomic Energy, CSIR	Strengthen capacity to mainstream the Convention obligations in the national development agenda; Strengthen regulation and enforcement capacity for the effective implementation of the Convention; identification, information containment and disposal of mercury and mercury containing devices; handling of Hg spills; best practices in mining and mineral processing including mercury-free methods; measurement of emissions and releases and identification of contaminated.	Articles 3 to 21
2	Ministry responsible for Minerals and Mining, the Minerals Commission Ghana and Geological Survey Authority	Strengthen capacity to develop policies for the effective implementation of the Convention particularly in large scale mining and in the ASGM sector; Strengthen capacity in relevant areas covered by the Convention especially in modern methods of survey, prospecting and demarcation of viable lands for ASGM operators	Article 3 Article 7 Article 8 Article 9
3	Ministry responsible for Trade and Ghana Standards Authority	Strengthen capacity to regulate mercury import and supply; Identification of mercury containing devices; certifying mercury free devices; monitoring and research	Article 3 Article 4 Article 5 Article 8



4	Ministry responsible for Health, Ghana Health Service, Food and Drugs Authority, Dental Council	Strengthen capacity in the management of mercury-related health diseases; identification, safe handling and disposal of mercury and mercury-containing devices; phase-down of dental amalgam; public awareness on health effects of mercury; proper use of alternative devices; certifying mercury free devices; monitoring and research	Article 3 Article 4 Article 7 Article 10 Article 11 Article 16
5	Ministry responsible for Information, Information Services Department, NCCE	Information dissemination	Article 18
6	Ministry responsible for Water resources; Water Resources Commission; Ghana Water Company; Water Research Institute of Council for Scientific and Industrial Research	Monitoring and research of water bodies; Capacity building on measuring mercury contents in potable water	Article 19
7	National Development Planning Commission	Mainstreaming the Convention obligations in National Development Plans	Articles 3-21
8	Ministry of Finance, Customs Division of the Ghana Revenue Authority	Identification of Hg and mercury containing devices at entry points;	Article 13
9	Ministry responsible for Local Government and Rural Development; Metropolitan, Municipal and District Assemblies	Waste Management	Article 7 Article 11 Article 12 Article 13 Article 17 Article 18



10	NGOs, Media	Awareness creation on the convention and alternatives of mercury containing devices, ASGM, monitoring and research	Article 3 Article 4 Article 5 Article 7 Article 14 Article 16 Article 18 Article 19
11	Ghana National Association of Small-scale Miners, Mining Communities	Capacity building on best practices in mining and mineral processing including mercury-free methods; information dissemination	Article 3 Article 4 Article 5 Article 7 Article 14 Article 16 Article 18 Article 19
12	Ghana Chamber of Mines, Ghana Institute of Freight Forwarders; Private Enterprises Federation, Ghana Chamber of Petroleum Consumers, Importers of Mercury and Mercury-containing devices, Association of Ghana	BAT/ BEP in industry, Awareness creation on alternatives of mercury containing devices	Article 3 Article 4 Article 5 Article 8 Article 10 Article 11 Article 12 Article 14 Article 16
13	Industries Research and Academia	Research, development and monitoring	Article 19
14	Ministry responsible for Education, Ghana Education Services, National Council for Tertiary Education, Educational Institutions	Awareness creation on the convention and alternatives of mercury containing devices and revision of curriculum ; vocational training.	Article 7 Article 14 Article 18
15	General public	Awareness creation on the convention and alternatives of mercury containing devices and consumer products (eg compact fluorescent lights, skin and soap lightening creams)	Article 6 Article 7 Article 14 Article 18



# Chapter Six

## IMPLEMENTATION PLAN AND PRIORITIES FOR ACTION

### PRIORITY 1: DOMESTICATION OF THE MINAMATA CONVENTION ON MERCURY

#### INTRODUCTION:

Ghana has already ratified the convention and therefore accepts its objective to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

#### OBJECTIVE :

Development of a legal framework that incorporates the obligations under the Minamata Convention as well as an administrative structure for its full and effective implementation.

#### OUTPUTS:

- National policy on lifecycle management on mercury developed;
- Legal framework to address the Minamata Convention and the obligations set out in its articles enacted;
- Administrative structure established with roles and responsibilities assigned
- Sustainable systems for reporting in accordance with the timing and format established by the COP instituted.

#### ACTIVITIES:

- Develop a national policy addressing the management of mercury throughout its life-cycle, compatible with the Minamata Convention and setting out short, medium and long-term priorities for action, agreed by all stakeholders.

- Repeal the existing Mercury law (Act 217,1989) and replace it with a new law that covers the provisions of the Convention, taking into account other existing laws.
- Build the administrative and institutional capacities to implement Convention obligations
- Establish systems for collecting national data taking into account information required for reporting under the convention
- Mainstream mercury management into national development agenda.

#### RELATIONSHIP WITH THE SDGS AND NATIONAL/REGIONAL DEVELOPMENT PLAN

The achievement of the objective under this priority shall contribute to national efforts in achieving the following targets in the National Development Plan, the Sustainable Development Goals and the AU Agenda 2063. The specific targets include the following;

- a. SDG 12 (Responsible Consumption and Production)
  - a. Target 12.4: "By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
- b. AU Agenda 2063: Aspiration 1. "A prosperous Africa based on inclusive growth and sustainable development"
- c. Government of Ghana's Coordinated Programme for Economic and Social Development (2017-2024).



## PRIORITY 2: REDUCE RISKS FROM MERCURY IN THE HEALTH SECTOR

### INTRODUCTION :

Mercury use in the health sector potentially exposes a wide range of people and communities to its adverse impacts. Through some ongoing programmes and projects such as UNDP/MOH Medical Waste Project, Minamata Initial Assessment for Ghana and the National Action Plan on ASGM, efforts are already underway to phase-out the use of mercury-containing devices as well as phasedown the use of amalgam in the health sector. In view of the potential risks populations could face, there is the need to intensify national efforts to reduce and where feasible, eliminate the use of mercury in Ghana's health sector.

### OBJECTIVES :

- Phase-out the use of mercury-added products from the health sector (Article 4, Annex A Part I)
- Phase down the use of dental amalgam (Article 4, Annex A Part II)

### OUTPUTS:

a)

- Products prohibited from manufacture, import and export by deadline, per Article 4 requirements
- Existing mercury-added products removed from use and replaced with mercury-free alternatives
- Mercury-added products managed and disposed in an environmentally sound manner in accordance with the Basel convention

b)

- Dental amalgam phased down

- Sustained growth in the use of alternative dental restorative materials
- Dental health-care professionals trained to use mercury-free alternatives
- Reduced releases of amalgam wastes from dental care delivery systems

### ACTIVITIES:

a)

- Develop National policy for phasing down/out Hg added products in Health sector
- Develop and disseminate guidelines covering all aspects of procurement of Hg added products and Hg free devices
- Development of national standards for Hg added products
- Development of a Hg added product collection and replacement strategy
- Development of a Hg waste collection, transportation and storage strategy
- Continue and complete the replacement of mercury-added products in the Ghana Health Service
- Promote the replacement of mercury-added products among private health practitioners
- Provide management and temporary storage facilities for all mercury-added products collected from the public and private health sector.
- Establish systems for the separation of mercury-added products from other healthcare waste streams, including those managed by environmental service providers



- Capacity building
- Promote the availability of mercury-free alternatives
- Promote the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land

b)

- Develop national policy aiming at phasing down the use of dental amalgam in dental-care delivery system
- Promote the use of cost-effective and clinically effective mercury-free alternatives for dental restoration;
- Promote research and development of quality mercury-free materials for dental restoration;
- Educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices;
- Review insurance policies and programmes that favour dental amalgam use over mercury-free dental restoration and engage the Ministry of Health to include the use mercury-free alternatives in health insurance scheme.
- Restrict the use of dental amalgam to its encapsulated form;

#### RELATIONSHIP WITH THE SDGS AND NATIONAL/REGIONAL DEVELOPMENT PLAN:

The achievement of the objective under this priority shall contribute to national efforts in achieving the following targets in National Development Plan, the Sustainable Development Goals and the AU Agenda. Specific targets include the following;

- SDG 12 (Sustainable Consumption and Production)
  - o Target 12.a: Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production.

d. AU Agenda 2063: Aspiration 1. "A prosperous Africa based on inclusive growth and sustainable development"

e. Government of Ghana's Coordinated Programme for Economic and Social Development (2017-2024)



## PRIORITY 3: ASGM NATIONAL ACTION PLAN

### INTRODUCTION:

ASGM is practiced by an estimated number of 1 million people and indirectly affects about 4.5 million people in Ghana. Emissions in this sector represents about 12.7 percent of total mercury emissions. Ghana is currently undertaking preparatory work to develop a national action plan to meet the requirements of Article 7: ASGM and Annex C.

This plan will need to address mercury use in ASGM within the broader socio-economic context of the communities engaged in the practice. It follows that a broad spectrum of stakeholders within government, civil society organizations and the communities will need to be involved in its preparation. The details of the activities required for this priority will be defined by the outputs of the National Action Plan.

### OBJECTIVE :

Reduce and where feasible, eliminate the use of mercury and mercury compounds in ASGM

### OUTPUTS:

- Mercury-free alternatives promoted and adopted
- Vulnerable populations and populations with high exposure to mercury protected.
- Mercury emissions and releases to the environment minimized or eliminated
- Mercury storage standards established and facilities available

### ACTIVITIES

- Pursue formalization of small scale mining sector, including helping miners to secure appropriate mineral rights and permits, as well as access to finance for better, mercury free technology
- Conduct research to identify mercury-free processing workflows that are tailored to specific ore types in specific geographical areas.
- Train Miners in the use of mercury-free alternatives that are cost-effective, easy to use and available. Assist with access to finance to allow miners to purchase equipment needed for mercury free methods
- Create awareness on the impact of mercury on human health and the environment
- Develop appropriate strategies to identify and assess mercury contaminated sites in ASGM communities and recommend appropriate methods for remediation (Article 12)

### RELATIONSHIP WITH THE SDGS AND NATIONAL / REGIONAL DEVELOPMENT PLAN:

The achievement of the objective under this priority shall contribute to national efforts in achieving the following targets in National Development Plan, the Sustainable Development Goals and the AU Agenda 2063. The specific targets include the following

- SDG 12 (Responsible Consumption and Production)



- o Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
- o Target 12.a: Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
- o Target 12.8: By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
- f. AU Agenda 2063 Aspiration 1. “A prosperous Africa based on inclusive growth and sustainable development”
- g. Government of Ghana's Coordinated Programme for Economic and Social Development (2017-2024)



## PRIORITY 4: REDUCE EMISSIONS AND RELEASES FROM POINT SOURCES IDENTIFIED IN ANNEX D OF THE CONVENTION.

### INTRODUCTION:

In the inventory we recognize that emissions and releases from industrial gold production and cement production point sources represent a sizable portion of Ghana's total mercury emissions and releases. Although roasting of gold ore is no longer practiced, it is considered that technologies being used are likely to lead to emissions and releases. Furthermore, current proposals for coal-fired power generation would constitute potentially new sources of emissions and releases.

### OBJECTIVE :

Reduce emissions and releases of mercury from point source categories

### OUTPUTS:

- Emissions from the production of industrial gold and of cement clinker minimized;
- Requirements for BAT/BEP incorporated into regulations establishing new point sources (Article 9)

### ACTIVITIES:

- Conduct emissions testing (or require companies to do so) to determine current levels of emissions at major point sources in these sectors
- Conduct process analyses to understand

actual mercury pathways in industrial gold processing and cement clinker production

- Determine with the industry concerned the steps that need to be taken to reduce emissions and releases.
- Determine BAT/BEP for new point sources in Ghana and incorporate it into industrial permitting regulations.
- Determine appropriate policy approach for addressing existing sources per Article 8.5.

### RELATIONSHIP WITH THE SDGS AND NATIONAL / REGIONAL DEVELOPMENT PLAN:

The achievement of the objective under this priority shall contribute to national efforts in achieving the following targets in National Development Plan, the Sustainable Development Goals and the AU Agenda 2063. The specific targets include the following;

- SDG 12 (Responsible Production and Consumption)
  - o Target 12.a: Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
- h. AU Agenda 2063: Aspiration 1. "A prosperous Africa based on inclusive growth and sustainable development"
- l. Government of Ghana's Coordinated Programme for Economic and Social Development (2017-2024)



## PRIORITY 5: MERCURY WASTES

### INTRODUCTION

As has been established by the results of the inventory, there are numerous areas of the Ghanaian society where mercury and mercury-added products are used of which all of them have the potential to become waste once they are no more in use. It has therefore become important that measures are taken to manage such wastes created from these sources.

It is also essential to make room for mercury-added products that will be systematically collected as waste, to ensure their phaseout/phasedown in accordance with the timelines stipulated in the convention (Annex A Part I and II).

### OBJECTIVE:

Manage mercury waste in an environmentally-sound manner to reduce/eliminate exposure to humans and the environment.

### OUTPUTS

- A national site for temporary storage for mercury waste developed
- Capacities of national officers built to manage mercury waste and temporary storage
- Mercury waste disposed of in an environmentally safe and sound manner

### ACTIVITIES

- Encourage the separation of mercury-containing products from municipal waste streams

- Develop an incentive scheme for the systematic collection of mercury-added products in various sectors
- Build interim storage facilities for interim storage of collected mercury containing products
- Identify disposal facilities abroad and transport under the Basel Convention notification system for environmentally sound management.

### RELATIONSHIP WITH THE SDGS AND NATIONAL / REGIONAL DEVELOPMENT PLAN:

The achievement of the objective under this priority shall contribute to national efforts in achieving the following targets in National Development Plan, the Sustainable Development Goals and the Africa Union Agenda 2063. The specific targets include the following;

- SDG 3 (Good health and wellbeing)
  - Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
- SDG 6 (Clean Water and Sanitation)
  - Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally



- SDG 11 (Sustainable Cities and Communities)
  - o Target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by Paying special attention to air quality and municipal and other waste management
- SDG 12 (Responsible Production and Consumption)
  - o Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
  - o Target 12.a: Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
- j. SDG 14 (Life below Water)
  - a. Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land based activities, including marine debris and nutrient pollution
- k. AU Agenda 2063: Aspiration 1. “A prosperous Africa based on inclusive growth and sustainable development.”
- c. Government of Ghana's Coordinated Programme for Economic and Social Development(2017-2024).

## OTHER PRIORITIES

- Institute research networks to conduct further studies on mercury content in populations dependent on fish
- Upgrading of selected laboratories to meet international best practices to analyze mercury emission and releases.
- Strengthening and Upgrading of Relevant Laboratories for Specialized Chemical Analysis that Will Include Mercury
- Certification of the upgraded laboratories by International Organization for Standardization (ISO).
- Institute a Prior Informed Consent procedure for trading in mercury



# Annexes

## ANNEX I: STAKEHOLDERS ENGAGED IN MIA PROCESS

Name	Institution	Name	Institution
F. Ohene-Mensah	AFI	Roger Gardiner	Ghana Revenue Authority Custom Division
Manuela D. Nelson	Asanko Gold	Joachim Davies	Ghana Revenue Authority Custom Division
NiiAdjetey Kofi Mensah	ASMAN	Mariam A. Rahman	Gold fields Ghana Limited
Tracy Jane-Lake	Attorney Generals Department	Charlotte Dsidsorna	Golden Star Bogoso
Vivian	Birth and Death Registry	Samuel Dotse	HATOF
Samuel Obiri	Centre for Environmental Impact Assessment	Larsey Mensah	Institute of Environmental Compliance and Sustainable Development
Dr. K. A Asante	Centre for Scientific and Industrial Research-Water Research Institute	Kwaku Treveh	International Labour Organization
Richard Ellimah	Centre for Social Impact Studies	RazafindrakotoMamyLalaina	International Labour Organization
Kenneth Kwame SwanzayEssuman	Chamber of Commerce - Tarkwa	Kwame Mensah	KASA Ghana
F-Ohene-Mensah	DEI	Smart-Abbey Ahimah	KASA Ghana
E. Odjam-Akumatey	Ecological Restoration	Priscilla Attafuah	Kinross Gold
Haruna	Energy Commission	Jonathan Hogarh	Kwame Nkrumah University of Science and Technology
Anifat Abu-Mahama	Environmental Protection Agency	Esther	Korle Bu Teaching Hospital
Diane Gasinu	Environmental Protection Agency	Eugene N. Korletey	Labour Department
Dr. Sam Adu-Kumi	Environmental Protection Agency	Nelson Ahedor	Minerals Commission
Ebenezer Appah-Sampong	Environmental Protection Agency	Frank Sofo	Ministry of Local Government & Rural Development.
Esi Nerquaye-Tetteh	Environmental Protection Agency	Cecelia Ansah-Obiri	Ministry of Employment and Labour Relations
Faisal Seidu	Environmental Protection Agency	Fredua Agyemang	Ministry of Environment, Science, Technology and Innovation
Felisa Owusu-Darko	Environmental Protection Agency	Amos Nana Acquah	Ministry of Finance
Gabriel Anthony Ampiah	Environmental Protection Agency	Dennis Akunmle	Ministry of Finance
George Lamptey	Environmental Protection Agency	Elizabeth Nancy Ameyaw	Ministry of Finance
Gifty Attah	Environmental Protection Agency	Jones Obeng	Ministry of Finance
Gifty Tetteh	Environmental Protection Agency	Konney Theresa	Ministry of Finance
Humu Saeed	Environmental Protection Agency	Kwesi Asante	Ministry of Finance



	Agency		
Irene Parker-Allotey	Environmental Protection Agency		
J.C Edmund	Environmental Protection Agency		
John A. Pwamang	Environmental Protection Agency		
John Tettey	Environmental Protection Agency		
Justine SeyireOzadzie	Environmental Protection Agency		
K. E Gura-Sey	Environmental Protection Agency		
Kafui Boni	Environmental Protection Agency		
Kani Lawrence Jnr	Environmental Protection Agency		
Lawrence Kani Jnr	Environmental Protection Agency		
Lovelace Sarpong	Environmental Protection Agency		
Michael Sandow Ali	Environmental Protection Agency		
Nathan Quao	Environmental Protection Agency		
SelaseSedzi	Environmental Protection Agency		
V.K Nartey	Environmental Protection Agency		
Victoria Leba-Kamanya	Environmental Protection Agency		
Victoria Leba-Kamanya	Environmental Protection Agency		
Yussif D. Iddisah	Environmental Protection Agency		
Dr. Crentsil Kofi Bempah	Environmental Youth Action Network/Ghana Atomic Energy Commission		
ShallovernSrodah	Federation of Ghana Goldsmith & Jewellers		
Solomon Kusi Ampofo	Friends of the Nation		
Gloria	Ghana Association of Small Scale Miners		
Comfort Okoe	Ghana Bauxite Company Ltd		
Theresa Konney	Ministry of Finance		
Francisca Atuluk	Ministry of Gender		
Patricia Dovi Sampson	Ministry of Information		
Deborah Mensah	Ministry of Interior		
Opoku Jacob	Ministry of Interior		
Ursula Renette Amoah	Ministry of Justice		
Ben Aryee	Ministry of Lands & Natural Resources		
Benjamin Aryee	Ministry of Lands & Natural Resources		
Rebecca Bortey	Ministry of Trade & Industry		
Michael A. Senayah	Ministry of Trade & Industry		
Samuel Cudjoe	National Petroleum Authority		
Susan Keane	Natural Resource Defence Council		
Doreen O. Drapson	Newmont Ghana Limited		
Vivian Odame	Perseus Mining Company		
NafisatuYussif	Solidaridad West Africa		
Nana Quame	Tema Metropolitan Assembly		
Joel Ayim Darkwah	United Nations Development Programme		
Louis Kuukpen	United Nations Development Programme		
Paolo Dalla Stella	United Nations Development Programme		
Etienne Gonin	United Nations Development Programme (MPU/Chemicals)		
Abena Nakawa	United Nations Development Programme /Ministry of Health		
Dr. Richard Amfo-Otu	United Nations Development Programme /Presbyterian University College		



Victoria	Ghana Crematoria Society
Felicia Hukportie	Ghana Gas Company
Dr. Carl Osei	Ghana Health Service/Ministry of Health
Dr. Edith Clarke	Ghana Health Service/Ministry of Health
Emmanuel Dzeble	Ghana National Association of Small Scale Miners
Emmanuel YirenskyiAntwi	Ghana National Association of Small Scale Miners
Daniel Asare	Ghana Ports and Harbour Authority

Joseph Yeboah	United Nations Industrial Development Organization
Fakhruddin Azizi	United Nations Industrial Development Organization
Yomi Banjo	United Nations Industrial Development Organization
Nelson Manda	United Nations Institute for Training and Research
Dr Ishmael Quaicoe	University of Mines and Technology
Isaiah Tuotienne	US Embassy
Karen Bel	US Embassy
Kate Ansah	Volta Aluminum Company
Georgette Sakyi-Addo	WIM & AMN
Sandra A.A.O. Donkor	WIM Ghana
Asferacew Abate	World Bank
Akosua Kwakye	World Health Organization



Group picture of participants at the inception meeting



UNDP Assistant Country Director – Programme making a speech at the validation workshop



Cross section of participants at the validation workshop





## ANNEX II: UNEP TOOLKIT Calculation Spreadsheet

INVENTORY LEVEL 1 – SPREAD SHEET											
Source category	Source present?			Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y						
	Y/N/?	Activity rate	Unit	Standard estimate	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment/disposal	Cat. no.
Energy consumption											
Coal combustion in large power plants	N	0	Coal combusted, t/y	-	-	-	-	-	-	-	5.1.1
Coal combustion in coal fired industrial boilers	N	0	Coal combusted, t/y	-	-	-	-	-	-	-	5.1.2.1
Other coal uses	?	0	Coal used, t/y	?	?	?	?	?	?	?	5.1.2.2
Combustion/use of petroleum coke and heavy oil	?	0	Oil product combusted, t/y	?	?	?	?	?	?	?	5.1.3
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	Y	3,356,549	Oil product combusted, t/y	18	18.5	0.0	0.0	0.0	0.0	0.0	5.1.3



Use of raw or pre-cleaned natural gas	Y	1,267,072,000	Gas used, Nm <sup>3</sup> /y	127	126.7	0.0	0.0	0.0	0.0	0.0	5.1.4
Use of pipeline gas (consumer quality)	N	0	Gas used, Nm <sup>3</sup> /y	-	-	-	-	-	-	-	5.1.4
Biomass fired power and heat production	Y	35,806,700	Biomass combusted, t/y	1,074	1,074.2	0.0	0.0	0.0	0.0	0.0	5.1.6
Charcoal combustion	Y	0	Charcoal combusted, t/y	0	0.0	0.0	0.0	0.0	0.0	0.0	5.1.6
Fuel production											
Oil extraction	Y	4,667,310	Crude oil produced, t/y	16	0.0	3.2	0.0	0.0	0.0	0.0	5.1.3
Oil refining	Y	359,584	Crude oil refined, t/y	1	0.3	0.0	0.0	0.0	0.0	0.2	5.1.3
Extraction and processing of natural gas	Y	568,502,528	Gas produced, Nm <sup>3</sup> /y	57	8.5	11.4	0.0	17.1	0.0	19.9	5.1.4
Primary metal production											
Mercury (primary) extraction and initial processing	N	0	Mercury produced, t/y	-	-	-	-	-	-	-	5.2.1
Production of zinc from concentrates	N	0	Concentrate used, t/y	-	-	-	-	-	-	-	5.2.3
Production of copper from concentrates	N	0	Concentrate used, t/y	-	-	-	-	-	-	-	5.2.4
Production of lead from concentrates	N	0	Concentrate used, t/y	-	-	-	-	-	-	-	5.2.5



Gold extraction by methods other than mercury amalgamation	Y	19,600,000	Gold ore used, t/y	19,600.0	784.0	392.0	17,640.0	784.0	0.0	0.0	5.2.6
Alumina production from bauxite (aluminium production)	Y	161,500	Bauxite processed, t/y	81	12.1	8.1	0.0	0.0	52.5	8.1	5.2.7
Primary ferrous metal production (pig iron production)	N	0	Pig iron produced, t/y	-	-	-	-	-	-	-	5.2.9
Gold extraction with mercury amalgamation - from whole ore	N	0	Gold produced, kg/y	-	-	-	-	-	-	-	5.2.2
Gold extraction with mercury amalgamation - from concentrate	Y	42,000	Gold produced, kg/y	45,150	32,547.9	6,526.8	6,075.3	0.0	0.0	0.0	5.2.2
Other materials production											
Cement production	Y	350,000	Cement produced, t/y	41	20.5	0.0	0.0	20.5	0.0	0.0	5.3.1
Pulp and paper production	N	0	Biomass used for production, t/y	-	-	-	-	-	-	-	5.3.2
Production of chemicals											
Chlor-alkali production with mercury-cells	N	0	Cl <sub>2</sub> produced, t/y	-	-	-	-	-	-	-	5.4.1
VCM production with mercury catalyst	N	0	VCM produced, t/y	-	-	-	-	-	-	-	5.4.2



Acetaldehyde production with mercury catalyst	N	0	Acetaldehyde produced, t/y	-	-	-	-	-	-	-	5.4.3
Production of products with mercury content											
Hg thermometers (medical, air, lab, industrial etc.)	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.1
Electrical switches and relays with mercury	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.2
Light sources with mercury (fluorescent, compact, others: see guideline)	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.3
Batteries with mercury	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.4
Manometers and gauges with mercury	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.6.2
Biocides and pesticides with mercury	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.5



Paints with mercury	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.6
Skin lightening creams and soaps with mercury chemicals	N	0	Mercury used for production, kg/y	-	-	-	-	-	-	-	5.5.7
Use and disposal of products with mercury content											
Dental amalgam fillings ("silver" fillings)	Y	24,223,431	Number of inhabitants	107	2.1	47.3	8.6	6.4	21.5	21.5	5.6.1
Thermometers	Y	850,750	Items sold/y	851	170.2	255.2	170.2	0.0	255.2	0.0	5.5.1
Electrical switches and relays with mercury	Y	24,223,431	Number of inhabitants	2,052	615.5	0.0	820.7	0.0	615.5	0.0	5.5.2
Light sources with mercury	Y	10,255,594	Items sold/y	178	53.3	0.0	53.3	0.0	71.1	0.0	5.5.3
Batteries with mercury	Y	26	t batteries sold/y	7,663	1,915.7	0.0	1,915.7	0.0	3,831.5	0.0	5.5.4
Polyurethane (PU, PUR) produced with mercury catalyst	Y	24,223,431	Number of inhabitants	440	87.9	44.0	175.9	0.0	131.9	0.0	5.5.5
Paints with mercury preservatives	?	0	Paint sold, t/y	?	?	?	?	?	?	?	5.5.7
Skin lightening creams and soaps with mercury chemicals	?	0	Cream or soap sold, t/y	?	?	?	?	?	?	?	5.5.8



Medical blood pressure gauges (mercury sphygmomanometers)	?	0	Items sold/y	?	?	?	?	?	?	?	5.6.2
Other manometers and gauges with mercury	Y	24,223,431	Number of inhabitants	73	14.7	22.0	14.7	0.0	22.0	0.0	5.6.2
Laboratory chemicals	Y	24,223,431	Number of inhabitants	147	0.0	48.4	0.0	0.0	48.4	49.8	5.6.3
Other laboratory and medical equipment with mercury	Y	24,223,431	Number of inhabitants	586	0.0	193.4	0.0	0.0	193.4	199.3	5.6.3, 5.6.5
Production of recycled of metals											
Production of recycled mercury ("secondary production")	N	0	Mercury produced, kg/y	-	-	-	-	-	-	-	5.7.1
Production of recycled ferrous metals (iron and steel)	Y	36,823	Number of vehicles recycled/y	41	13.4	0.0	13.8	0.0	13.4	0.0	5.7.2
Waste incineration											
Incineration of municipal/general waste	N	0	Waste incinerated, t/y	-	-	-	-	-	-	-	5.8.1
Incineration of hazardous waste	y	1,120	Waste incinerated, t/y	27	24.2	0.0	0.0	0.0	0.0	2.7	5.8.2
Incineration and open burning of medical waste	Y	844	Waste incinerated, t/y	20	20.3	0.0	0.0	0.0	0.0	0.0	5.8.3



Sewage sludge incineration	N	0	Waste incinerated, t/y	-	-	-	-	-	-	-	5.8.4
Open fire waste burning (on landfills and informally)	Y	1,852,800	Waste burned, t/y	9,264	9,264.0	0.0	0.0	0.0	0.0	0.0	5.8.5
Waste deposition/landfilling and waste water treatment											
Controlled landfills/deposits	Y	146,766	Waste landfilled, t/y	734	7.3	0.1	0.0	-	-	-	5.9.1
Informal dumping of general waste	Y	2,632,434	Waste dumped, t/y	13,162	1,316.2	1,316.2	10,529.7	-	-	-	5.9.4
Waste water system/treatment	Y	712,000,000	Waste water, m <sup>3</sup> /y	3,738	0.0	3,364.2	0.0	0.0	373.8	0.0	5.9.5
Crematoria and cemeteries											
Crematoria	Y	9	Corpses cremated/y	0	0.0	0.0	0.0	-	0.0	0.0	5.10.1
Cemeteries	Y	180,000	Corpses buried/y	450	0.0	0.0	450.0	-	0.0	0.0	5.10.2
TOTAL of quantified releases				81,060	48,100.0	8,870.0	27,340.0	830.0	5,630.0	300.0	



## ANNEX III USEFUL RESOURCES

- Minamata Convention Website:  
<http://www.mercuryconvention.org/>
- Minamata Convention Text  
<http://www.mercuryconvention.org/Convention/tabid/3426/Default.aspx>
- Materials developed by the interim secretariat of the Minamata Convention  
<http://www.mercuryconvention.org/AwarenessRaising/Resources/tabid/3873/Default.aspx>
  - \* Becoming a Party to the Minamata Convention on Mercury (FACT SHEET)
  - \* Minamata Convention on Mercury at a glance (FACT SHEET)
  - \* Overview of the negotiations process (PPT)
  - \* Overview of the Minamata Convention on Mercury (PPT)
  - \* Provision of the Convention on financial and technical support (PPT)
  - \* Practical steps of the ratification, acceptance, approval or accession processes and notifications under the Minamata Convention (PPT)
- Toolkit for Identification and Quantification of Mercury Releases (UNEP)  
<http://www.unep.org/chemicalsandwaste/Metals/MercuryPublications/GuidanceTrainingMaterialToolkits/MercuryToolkit/tabid/4566/language/en-US/Default.aspx>
- MercuryLearn Platform (UNITAR/UNEP)  
<http://mercurylearn.unitar.org/>
- List of Country Mercury Release Inventories (UNEP)  
<http://www.unep.org/chemicalsandwaste/hazardoussubstances/Mercury/Informationmaterials/ReleaseInventories/tabid/79332/Default.aspx>
- Checklist of legal authorities to implement Minamata Convention on Mercury [Natural Resources Defense Council - NRDC]  
[http://docs.nrdc.org/international/files/int\\_15101301a.pdf](http://docs.nrdc.org/international/files/int_15101301a.pdf)
- Minamata Convention on Mercury - Ratification and Implementation Manual [Zero Mercury Working Group, Natural Resources Defense Council, Ban Toxics]  
[http://www.zeromercury.org/phocadownload/Developments\\_at\\_UNEP\\_level/minamatamanual\\_eng\\_january%202015%20final.pdf](http://www.zeromercury.org/phocadownload/Developments_at_UNEP_level/minamatamanual_eng_january%202015%20final.pdf)
- Guidance for identifying populations at risk from mercury exposure (WHO/UNEP)  
<http://www.who.int/foodsafety/publications/risk-mercury-exposure/en/>
- Developing a National Action Plan to Reduce, and Where Feasible, Eliminate Mercury Use in Artisanal and Small Scale Gold Mining (UNEP, 2015)  
[HTTP://WWW.UNEP.ORG/CHEMICALSANDWASTE/NATIONALACTIONPLAN/TABID/53985/DEFAULT.ASPX](http://www.unep.org/chemicalsandwaste/nationalactionplan/tabid/53985/Default.aspx)
- Chemicals Management: The why and how of mainstreaming gender (UNDP, 2007)  
[http://www.undp.org/content/undp/en/home/library/page/environment-energy/chemicals\\_management/chemicals-management-the-why-and-how-of-mainstreaming-gender.html](http://www.undp.org/content/undp/en/home/library/page/environment-energy/chemicals_management/chemicals-management-the-why-and-how-of-mainstreaming-gender.html)
- Draft guidance on identification of individual stocks of mercury or mercury compounds exceeding 50 metric tons, as well as sources of mercury supply generating stocks exceeding 10 metric tons per year  
[http://www.mercuryconvention.org/Portals/11/documents/meetings/inc7/English/7\\_4\\_e\\_stock.pdf](http://www.mercuryconvention.org/Portals/11/documents/meetings/inc7/English/7_4_e_stock.pdf)



## ANNEX IV. BIBLIOGRAPHY

1. Amfu-Otu/MoH/GHS/UNDP (2014). Final report on Initial Assessment of Levels of UPOPs and Mercury Releases into the Environment Resulting from HCMW in Ghana. Available through UNDP Ghana.
2. CEPS Vehicles Import Data, 2015.
3. Civil Engineering Department of KNUST, 2016. Assessment of Waste water Treatment Plants in Ghana. UNICEF Report. July, 2016
4. Driver Vehicle and Licensing Authority, 2015.
5. Ghana Energy Commission (2014). National Energy Statistics 2000-2013. Accra. Available from Ghana Chamber of Mines (2014). Performance of the mining industry in 2013. Accra, Ghana, Ghana Chamber of Mines, 10 p. (Accessed October 12, 2013, at [http://ghanachamberofmines.org/media/publications/Performance\\_of\\_the\\_Mining\\_Industry\\_in\\_2013.pdf](http://ghanachamberofmines.org/media/publications/Performance_of_the_Mining_Industry_in_2013.pdf)).
6. Ghana Energy Commission (2016). National Energy Statistics 2006-2015. Statistics Planning and Policy Division, April, 2016.
7. Ghana News Agency Report (2012). Ghana needs mining investment law. African Center for Energy Policy (ACP). [www.Ghananewsagency.org](http://www.Ghananewsagency.org) (assessed on December, 2017)
8. Ghana Statistical Service (2016). Digest of International Merchandise Trade Statistics (2011-2015).
9. Ghana Statistical Service (GSS) (2012). 2010 Population and Housing Census. Summary Report of Final Results. Accra. Available from [http://www.statsghana.gov.gh/docfiles/2010phc/Census2010\\_Summary\\_report\\_of\\_final\\_results.pdf](http://www.statsghana.gov.gh/docfiles/2010phc/Census2010_Summary_report_of_final_results.pdf).
10. Ghana Statistical Service, 2014, Gross domestic product (2014). Accra, Ghana, Ghana Statistical Service, April 9, 9 p. (Accessed May 14, 2014, at [http://www.statsghana.gov.gh/docfiles/GDP/GDP\\_2014.pdf](http://www.statsghana.gov.gh/docfiles/GDP/GDP_2014.pdf)).
11. [http://www.energycom.gov.gh/files/ENERGY%20STATISTICS\\_2014\\_FINAL.pdf](http://www.energycom.gov.gh/files/ENERGY%20STATISTICS_2014_FINAL.pdf).
12. Hilson G., Pardie S. Mercury: An agent of poverty in Ghana's small-scale gold-mining sector? *Resour. Policy*. 2006;31:106–116. doi: 10.1016/j.resourpol.2006.09.001.
13. IEA database (2015 data), accessed 28 Feb 18 at <http://www.iea.org/statistics/statisticssearch/report/?year=2015&country=GHANA&product=NaturalGas>
14. Ministry of Finance (2014). Ghana Extractive Industries transparency Initiative Report on Oil and Gas Sector, 2014.
15. MoH/GHS (2010). The Health Sector in Ghana-Facts and Figures. Available at [http://www,moh-ghana.org/UploadFiles/Publications/GHS%20Facts%20and%20Figures%202010\\_22APR2012.pdf](http://www,moh-ghana.org/UploadFiles/Publications/GHS%20Facts%20and%20Figures%202010_22APR2012.pdf).
16. Reference Report and Guideline for Inventory Level 2, Version 1.4, December 2017. UNEnvironment. Chemicals Branch, Geneva, Switzerland.
17. George O., Nketiah-Amponsah, E., Codjoe, S.N.I., Afutu-Kotey, R.L. (2014) How do Ghana's landfills affect residential property values? A case study of two sites in Accra, *Urban Geography*, 35:8, 1140-1155, DOI: 10.1080/02723638.2014.945261
18. Savanna Company Limited, 2017. Personal Communication from Savannah 2017



19. Rajae M, Obiri S, Green A, et al. Integrated Assessment of Artisanal and Small-Scale Gold Mining in Ghana—Part 2: Natural Sciences Review. Keane S, Moher PB, eds. *International Journal of Environmental Research and Public Health*. 2015;12(8): 8971-9011. doi:10.3390/ijerph120808971.
20. Terkper, S.E. (2014). 2014, 2013 annual report on the petroleum funds: Accra, Ghana, Ministry of Finance, 25 p. (Accessed July 10, 2014, at [http://www.mofep.gov.gh/sites/default/files/reports/2013\\_Annual\\_Petroleum\\_Report.pdf](http://www.mofep.gov.gh/sites/default/files/reports/2013_Annual_Petroleum_Report.pdf)).
21. UN Environment (2017a). Global mercury supply, trade and demand. United Nations Environment Programme, Chemicals and Health Branch. Geneva, Switzerland.
22. UN Environment (2017b). Toolkit for Identification and Quantification of Mercury Sources.
23. UNDP (2015). NAMA Study for a Sustainable Charcoal Value Chain in Ghana.
24. UNDP/MoH (2009). Reducing Unintentional Persistent Organic Pollutants (UPOPs) and mercury Releases from the Health Sector in Africa.
25. UNEP (2013). Toolkit for Identification and Quantification of Mercury Sources, Guideline for Inventory Level 1, Version 1.2. UNEP Chemicals Branch, Geneva, Switzerland.
26. United States Geological Survey (2014). Minerals Yearbook for Ghana. U.S. Department of the Interior. U.S. Geological Survey.
27. Veiga, M. M., Maxson, P., Hylander, L. D. (2006). Origin of mercury in artisanal and small-scale gold mining, *Journal of Cleaner Production*. 14, 436.
28. World Bank (2016). Mercury trade and use for artisanal and small-scale gold mining in Sub-Saharan Africa, draft final report, COWI A/S, 7 September 2016.
29. World Bank website. Population Estimates and Projections. Available from <http://datatopics.worldbank.org/hnp/popestimates>.



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## ANNEX VI. MINERALS COMMISSION'S INFORMATION ON THE GEOCHEMICAL COMPOSITION OF GHANA'S GOLD ORE.

MINERALS COMMISSION



### MINERALS COMMISSION

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Our Ref: MC 26/Vol.7

15<sup>th</sup> August, 2018

The Executive Director  
Environmental Protection Agency  
P. O. Box MB 326  
Ministries Post Office  
Accra

**ATTN.: ING. MICHAEL SANDOW ALI**

Dear Sir,

**RE: REQUEST FOR INFORMATION ON THE GEOCHEMICAL  
COMPOSITION OF GHANA'S GOLD ORES**

Your letter number GB: 179/250/02/46, dated 18<sup>th</sup> July 2018 on the above subject refers.

We forward herewith information relating to the Geology, Mineralisation and Processing of Gold in Ghana, for your attention.

Please, do not hesitate to revert to the Commission for further clarification, should there be any.

Yours faithfully,

(ADDAE ANTWI-BOASIAKO)  
CHIEF EXECUTIVE OFFICER

Encl.



# BRIEF ON THE GEOLOGY, MINERALISATION AND GOLD PROCESSING IN GHANA

## 1.0 INTRODUCTION

Ghana signed on to the Minamata Convention on Mercury on 24th September, 2014 and had treaty ratified on 23rd March, 2017. The ratification made it binding on Ghana to uphold and adhere to this international treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

As part of the country's action and obligation under the Minamata Convention on Mercury, a study was commissioned in respect of the Minamata Initial Assessment (MIA) to evaluate the mercury situation in Ghana.

At a workshop held on 10th July, 2018 to validate the MIA Report, it was reported that the contribution of Large-scale Mining Companies to mercury release is far in excess of the estimates of the Artisanal Small-scale Mining sub-sector, which was known as the single largest user of mercury.

The Environmental Protection Agency's (EPA) interest in this matter is to ascertain the veracity of the claims in the MIA Report.

The Agency has therefore written to the Minerals Commission for information on the geochemical composition of the country's gold ores reported to Government.

## 2.0 GENERAL GEOLOGY OF GHANA

The Lower Proterozoic rocks of Ghana comprise turbiditic sedimentary rocks and mafic-to-intermediate volcanics/hypabyssal rocks of the Birimian Supergroup, the fluvial molasse sediments of the Tarkwaian Group and various granitoid intrusions

(Junner 1935; Luebe and Hirdes 1986; Luebe et al., 1990).

The Birimian Supergroup constitutes separate North-East striking belts of turbiditic sedimentary rocks and mafic-to-intermediate volcanic rocks. The volcanic belt also comprises small components of felsic and ultramafic rocks. The Tarkwaian Group sedimentary rocks include the gold-bearing Banket and the unmineralised Kawere Series conglomerates, various fluvial sandstone units and minor shales.

The Tarkwaian Group is usually found in close proximity to the Birimian volcanic rocks either as unconformable stratigraphic contacts or as imbricated fault-bounded slices.

The Birimian Supergroup and Tarkwaian Group have been intruded by granitoids and porphyry at different periods and have together undergone structural deformations and metamorphic development.

The principal Birimian meta-volcanic belt and meta-sedimentary basins in Ghana are the Kibi-Winneba Belt, Cape Coast Basin (Birim River Basin), Ashanti Belt, Kumasi Basin (Asankrangwa Belt), Sefwi-Bibiani Belt, Sunyani Basin, Bui Belt, Maluwe Basin, Bole-Nangodi Belt and Wa Lawra Belt.

Factually, the Birimian hosts the world class Obuasi gold deposit; it also hosts the Prestea, Bogoso, Ayanfuri, Amansie, Konongo, Bibiani, Chirano and Yamfo gold deposits among others. Gold deposits in the Tarkwaian include Abosso, Tarkwa, Iduapriem and Akyempim.

## 3.0 MINERALISATION

Most of the primary mineralisation in Ghana is closely tied up with the Birimian Supergroup and especially in the proximal metasediments along the margins of the 'greenstone' belts. In addition, there are significant alluvial (placer) concentrations that occur in the Tarkwaian conglomerates.



The Birimian Supergroup has been intruded by granitoids and porphyry at different periods and contributing in many ways to the gold mineralisation. Due to extensive exploration in Ghana, important mineralisation types have been identified and documented. Even though, these types of 'low grade' mineralisation were known in the past, recent new technologies have made their development into profitable operations possible. These mineralisation types include the following:

- i. Quartz-carbonate veins hosted within deformed carbonaceous phyllite in the Birimian, which is usually free-milling gold mineralisation as found in Prestea and Obuasi.
- ii. Disseminated sulphides associated with quartz vein system in Birimian metaclastics; frequently, these are medium to high grade and are commonly refractory (very finegrained gold encapsulated in pyrite and arsenopyrite). These require pre-treatment (roasting or biooxidation) but are commonly quite wide so they can be mined as openpit operation or mined underground by efficient mechanized means.
- iii. Quartz veins and associated sulphides disseminations hosted by belt-type intermediate to mafic intrusions.
- iv. Low-grade paleo-alluvial gold associated with wider sections of conglomerate and sandstones within the Banket Series of the Tarkwaian. Efficient mining and low-cost extraction [heap leach or carbon-in-leach (CIL)/carbon-in-pulp (CIP)] of gold has led to an enormous increase in production in the Tarkwa area.
- v. Quartz veins and associated sulphide disseminations hosted by Tarkwaian metasediments such as at Damang.
- vi. Weathering of primary sulphides deposits (Sulphides), commonly refractory, has liberated gold and made possible open-pit mining of low grade deposits (Oxides).

Source: Minerals Commission  
Monitoring and Evaluation Department

vii. The alluvial concentration of gold in present river systems, which are mined by artisanal methods, are now targets for open pit mining in some traditional goldmining districts such as Manso Nkwanta and Kibi.

## 4.0 CHEMICAL COMPOSITION OF MINERALS ASSOCIATED WITH GOLD MINERALISATION

Regional and local geological structures appear to play a critical role in localizing economic concentrations of gold for all primary veins or disseminated sulphide gold occurrences.

Virtually all kinds of host rocks are suitable but the most favoured often appears to be those with significant iron content (iron oxide or iron sulphides) as the iron helps in the rapid precipitation of gold and sulphur from hydrothermal solutions.

### 4.1 DISSEMINATED SULPHIDES

The disseminated sulphides reported in Ghana are mostly pyrite, chalcopyrite and arsenopyrite.

- i. Pyrite (Iron Sulphide): The mineral pyrite is an iron sulphide with the chemical formula  $FeS_2$  [iron (II) disulphide] and is considered the most common of the sulphide minerals. It is also referred to as "Fool's Gold".
- ii. Chalcopyrite (Copper Iron Sulphide): Chalcopyrite is a copper iron sulphide mineral with the chemical formula  $CuFeS_2$ .
- iii. Arsenopyrite (Iron Arsenic Sulphide): Arsenopyrite is an iron arsenic sulphide ( $FeAsS$ ). Although there may be several stages of gold deposition and redistribution, it appears that no stage of gold mineralisation with mercury occurrence has been reported as a critical constituent of the known deposits.



- iv. Cinnabar (Mercury Sulphide - HgS): Cinnabar is a mercury sulphide mineral and the most common source ore for refining elemental mercury. Cinnabar has not yet been found in gold mineralisation in Ghana.

## 4.2 Oxides

The most common iron oxides known in Ghana include:

- i. Iron (III) oxide or ferric oxide has the formula  $\text{Fe}_2\text{O}_3$  (Hematite) and is widespread.
- ii. Iron (II, III) oxide ( $\text{Fe}_3\text{O}_4$ ), which occurs naturally as the mineral Magnetite and is the most magnetic of all the naturally-occurring minerals on Earth.
- iii. Iron (II) oxide ( $\text{FeO}$ ), which is rare.

## 5.0 MINERAL PROCESSING METHODS

The general gold processing comprises a conventional

crushing and grinding circuit in all the mines in Ghana. Crushed ore is conveyed to the grinding circuit, where it is ground using a semi-autogenous grinding (SAG) mill in a closed circuit and a tower mill feed prep vibrating screen. Secondary grinding is carried out in closed circuit with cyclones and a gravity circuit, where about 40% of gold is usually recovered up front.

This process is followed by a high cyanidation leach circuit, CIL/CIP adsorption circuit, and a carbon stripping circuit. The solution is lastly sent to an electro-winning circuit for gold removal and then for on-site smelting into gold bars.

There is no aspect of the processing that involves the use of mercury in the treatment of ore recovery of gold by large-scale mining companies in Ghana.

Table 1 below is a summary of the methods of mining and processing applied by the various producing mines in Ghana.



Table 1: Summary of mining and processing methods used by various producing mines in Ghana

NAME OF COMPANY	LOCATION	MINING METHOD	TYPE OF ORE	MAIN PRODUCT	BY PRODUCT	PROCESSING METHOD
1. Adamus Resource Ltd	Nzema	Surface	Oxide/Sulphide	Gold	Silver	Cyanidation and Gravity
2. Gold Fields Ghana Ltd	Tarkwa	Surface	Conglomerate	Gold	Silver	Carbon-in-Leach
3. Gold Fields Ghana Ltd	Damang	Surface	Oxide/Sulphide	Gold	Silver	Carbon-in-Leach
4. Newmont Ghana Gold Ltd	Ahafo	Surface/ Underground	Oxide/Sulphide	Gold	Silver	Carbon-in-Leach
5. Newmont Golden Ridge Ltd	Akyem	Surface	Oxide/Sulphide	Gold	Silver	Carbon-in-Leach
6. Golden Star (Prestea-Bogoso) Ltd	Prestea Bogoso	Surface/ Underground	Oxide/Sulphide	Gold	Silver	Carbon-in-Leach/Biooxidation
7. Golden Star (Wassa) Ltd	Wassa	Surface/ Underground	Oxide/Sulphide	Gold	Silver	Carbon-in-Leach/Biooxidation
8. Perseus Mining Ltd	Edikan	Surface	Oxide	Gold	Silver	Carbon-in-Leach
9. Asanko Mining Ltd	Abore	Surface	Oxide/Sulphide	Gold	Silver	Carbon-in-Leach
10. AngloGold Ashanti (Obuasi) Ltd	Obuasi	Surface/ Underground	Oxide/Sulphide	Gold	Silver	Biooxidation
11. AngloGold Ashanti (Iduaprim) Ltd	Iduaprim	Surface	Oxide	Gold	Silver	Carbon-in-Leach
12. Kinross Gold Mining Ltd	Chirano	Surface/ Underground	Oxide	Gold	Silver	Carbon-in-Leach
13. Kibi Goldfields Ltd	Osino	Alluvial Mining	Free-Milling	Gold	Silver	Prospector and Gravity Concentration
14. Xtra Gold Mining Ltd	Kwabeng	Alluvial Mining	Free-Milling	Gold	Silver	Prospector and Gravity Concentration

Source: Minerals Commission



## 6.0 CONCLUSION

It is clear that

1. Mineralisation in Ghana has significant iron content (iron oxide or iron sulphide), which helps in the rapid precipitation of gold and sulphur from hydrothermal solutions.
2. The Oxides do not have mercury associated with them.
3. The Sulphide mineralisation is commonly associated pyrite (FeS), arsenopyrite (FeAsS) and chalcopyrite (CuFeS). No cinnabar (HgS) has so far been reported as part of any sulphide/gold mineralisation in Ghana.
4. The metallurgical processing of ore minerals (oxides and sulphides) in Ghana includes the grinding circuit, gravity concentration, cyanidation leach circuit, CIP/CIP adsorption circuit, and a carbon stripping circuit and the solution passed through electro-winning circuit for gold recovery.

5. The treatment of refractory sulphides is by bio-oxidation process.
6. Alluvial processing of free-milling gold is by prospector and gravity concentration circuit. There is therefore no record of mercury sulphide associated with gold mineralisation in Ghana and also no large-scale gold mining company is consuming mercury in the processing of gold. Accordingly, the claims in the Minamata Initial Assessment (MIA) Report must be looked at again and the source of information critically verified.

### REFERENCES

- Junner, N. R., 1935. The Tarkwa Goldfield. Geological Survey Memoir.
- Luebe and Hirdes 1986. The Birimian supergroup of Ghana — depositional environment, structural development and conceptual model UN Environment Programme. Copyright 2018 by Minamata Convention on Mercury



MINAMATA  
CONVENTION  
ON MERCURY



MAKE  
MERCURY  
HISTORY

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