MINAMATA CONVENTION ON MERCURY

INITIAL ASSESSMENT REPORT FOR NIGERIA

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June, 2017

FOREWORD

Mercury (Hg) does not only pose significant local contamination problems, but its elemental form can be oxidized and travel long distances through the atmosphere and /or deposited in ecosystems. In aquatic systems, mercury from local and distant sources can be converted into methylmercury, a serious neurotoxin. High-dose exposure to methylmercury can lead to significant neurological damage, heart disease and fatalities. Low-dose exposure has been linked to developmental delays and neurological damage affecting brain and muscle capacity, especially in small children. Thus, mercury remains a major global, regional and national challenge in terms of threat to human health and the environment.

Although, mercury is released into the environment through natural phenomena, the bulk of environmental mercury now comes from human activities. In Nigeria, the major sources of mercury emissions and releases are through the following economic activities: artisanal and small-scale gold mining (ASGM), use and improper disposal of mercury containing products and their wastes, cement production, oil & gas exploration and exploitation activities.

In support of global measure to address the increasing level of mercury in the environment, Nigeria joined the rest of the world to negotiate the Minamata Convention on Mercury-a global, legally binding treaty; and, having agreed to the text of the Convention, signed it on 10th October 2013. The Federal Executive Council (FEC) on 12th April 2017 approved the ratification of the Convention and the Federal Ministry of Justice is currently preparing the instrument of ratification for Mr. President's signature.

To this end, Nigeria with the support of the Government of Switzerland and the United Nations Institute for Training and Research (UNITAR) executed a project in 2014 titled "Ratification and Early Implementation of the Minamata Convention on Mercury in Nigeria". The major outcomes of this project are the development of a ratification dossier for the implementation of the Convention; and information note on the Minamata Convention on Mercury to create awareness among national stakeholders about the Convention and its benefits for the country. To further assist Nigeria in completing pre-ratification activities under the Minamata Convention to enable policy and strategic decision-making and to prioritize areas for future interventions on mercury related issues; the United Nations Industrial Development Organization (UNIDO) and UNITAR collaborated with Nigeria to implement a Global Environment Facility (GEF) funded project title "Minamata Convention Initial Assessment in Nigeria".

The development and adoption of this document- Minamata Convention on Mercury Initial Assessment report for Nigeria, which is the first to be developed under the Convention by any country, is a practical demonstration of the commitment of the Government of Nigeria towards the implementation of the provisions of the Minamata Convention on Mercury. This document is presented to all Nigerians and development partners for implementation and support towards the protection of human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds with the Federal Ministry of Environment (FMEnv) serving as the coordinating Ministry. A pollution free environment is our goal. We hope that this document will go a long way to help in achieving this goal.

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ACKNOWLEDGMENT

The Federal Ministry of Environment in close collaboration with the United Nations Industrial Development Organization (UNIDO) and the United Nations Institute for Training and Research (UNITAR) under the guidance of the project's National Steering Committee (NSC) coordinated the implementation of the Minamata Convention on Mercury Initial Assessment (MIA) in Nigeria project and the outstanding success of the project is as a result of hardwork, research, commitment, dedication and inclusive participation of many individuals and organisations.

The Federal Ministry of Environment on behalf of the Federal Government of Nigeria hereby expresses profound gratitude to the members of the National Steering Committee and all national stakeholders who made contributions to the development of this document. The efforts of the project Team and consultant are acknowledged for the hardwork towards the smooth execution of the project. The project team comprise of Mr. Abdulkazeem Bayero (Project Coordinator) who was later succeeded by Dr. Idris Goji, Mr. Olubunmi Olusanya (Assistant Project Coordinator), Mr. John Adefemi Adegbite (Mercury Expert), Mrs. Oluwatoyin Olabanji (Project Technical Officer), Mr. Ahmed Bah (Assistant Technical Officer), Ms. Nkiru Ogbodo (Assistant Technical Officer), Mrs. Agnes Ogu (Secretary) and Dr. Michael Okoh (UNITAR's Consultant).

Our appreciation also goes to the Global Environment Facility (GEF) for providing the financial assistance for the implementation of this project, UNIDO and UNITAR for their technical assistance toward the development of this document. I will like to acknowledge specially the key roles played by Dr. Jean Bakole (Representative and Director, UNIDO Regional Office Nigeria and West Africa), Ms Rodica Ivan (Project Manager, UNIDO), Mr. Yomi Banjo (Environment Expert, UNIDO), Mr. Jorge Ocana (Manager of the Chemicals and Waste Programme of UNITAR) and Mr. Nelson Manda (Senior Specialist) towards the success of the entire MIA project. The Ministry also appreciates the role of UNITAR's international consultants Mr. Jakob Maag and Mr. David Piper in reviewing the document during the development and finalisation stages.

The Federal Government of Nigeria is committed to ensuring the protection of human health and environment from the hazards of mercury. This document provides in-depth information on Nigeria's issues with respect to mercury management and should be widely disseminated to all relevant stakeholders for necessary actions.

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Introduction

As an element, mercury is persistent in the environment and is naturally released into the air as vapour during natural processes such as volcanic activity, weathering of rock, water body movement, forest fires, and natural processes. While natural releases continue, they do not account for the considerable increase in environmental mercury levels since the on-set of the industrial era: it is clear that significant mercury is released from a range of human activities. It is now estimated that: roughly 10 per cent of the emissions of mercury to the atmosphere are from natural processes; a further 30 per cent is generated by current human activity; and the remaining 60 per cent is re-emissions (e.g. evaporation) of mercury already in the environment, mostly as a result of previous human activity (UNEP, 2013a).

Activities contributing to 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, in artisanal and small-scale gold mining, and the breakage and improper disposal of mercury-containing products.

All forms of mercury are toxic although the risk of intoxication to humans varies considerably as some forms are less harmful than others.

With UNEP's first Global Mercury Assessment (UNEP, 2002) came widespread recognition that the nature and behaviour of mercury in the environment, including its abilities for long-range transport in the atmosphere, its persistence, and its ability to bio-accumulate in the ecosystem leading to significant adverse effects on both human health and the environment, are of global concern requiring globally coordinated action (UNEP, 2013a).

Agreement to negotiate a legally binding instrument to restrict anthropogenic releases was reached by the UN Environment Governing Council in 2009 that requested UN Environment to convene an Intergovernmental Negotiation Committee (INC) beginning in 2010. After a series of INC meetings, the treaty text was agreed by 147 Governments on January 19, 2013 in Geneva, Switzerland, and the Convention was adopted and opened for country signatures 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, 2013c).

The overall objective of the Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds (UNEP 2013c). It was adopted to promote 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, and provides for the control and phasing out and/or phasing down of mercury and mercury added products (UNEP, 2013).

As of 29 June 2017, 128 countries, including Nigeria, had signed the Convention and 70 had ratified it. The Convention will enter into force on the 16th August 2017.

To provide a structured process to enable countries to determine what is needed in order to ratify the Convention and to provide a basis for subsequent work towards implementation, the Minamata Convention Initial Assessment (MIA) was developed. Initial guidelines for the MIA (Global Environment Facility, 2013) and summary of the provisions of the convention is presented in the introduction section of the document.

National Background Information

Chapter I of the document gives a summary of country profile data for the Federal Republic of Nigeria, including information on the capital city, area, land boundaries, coastline, climate, land use, irrigated land, natural hazards, environmental issues, geography, note, population administrative divisions, population demographics, growth rate, infant mortality, life expectancy, fertility rate, ethnic groups, religions languages, literacy, independence, Gross Domestic Product (GDP), GDP real growth, GDP per capita and GDP composition.

Mercury Inventory and Identification of Emissions and Releases in Nigeria

This section (chapter II) provides details on inventory planning, preparation and management. It highlights the major sources of mercury emissions and releases in Nigeria including, production, use, wear and tear and disposal of mercury-added products; artisanal and small-scale gold mining (ASGM); coal-fired power plants and industrial boilers; smelting and roasting processes used in non-ferrous metal production; cement production; industrial emissions; waste management; oil & gas exploration; exploitation activities; and contaminated sites.

The section also details the result of the inventory of mercury emissions and release and its implication for Nigeria as a Party to the Minamata Convention.

Policy, Regulatory and Institutional Framework Assessment

Detailed assessment of existing policy, regulatory and institutional framework is provided in chapter III of the document.

Identification of Populations at Risk and Gender Dimensions

This section (chapter IV) gives a detailed insight to Populations at risk and gender dimensions

Awareness and Understanding of Workers and the Public

Nigeria has commenced awareness programmes on the harmful effects of mercury The focus of these programmes has been on key sectors including health, mining and steel, industry, agriculture and labour and productivity, non-governmental organisations (NGOs) and academia. Activities undertaken are presented in chapter V of the document.

Implementation Plans and Priorities for Action

In order for Nigeria to meet its obligations under the treaty, a range of actions needs to be taken to address the many aspects of the anthropogenic use of mercury. These actions include making the necessary regulatory and administrative arrangements for the proper work of the Convention at the national level; working with the private sector and investors to ensure that emissions and releases from industrial point sources are controlled and minimized; prohibiting or limiting the use of mercury-containing products and encouraging consumers to accept alternatives; assisting vulnerable populations engaged in ASGM to halt practices that have serious impacts on health and the environment; and preventing mercury and mercury-containing products from entering waste streams.

National stakeholders through consultations have identified national priority actions to be taken in order to protect the population and environment from the hazardous effects of mercury. These priority actions are presented in Chapter VI of the document.

GLOSSARY OF TERMS, UNITS AND ACRONYMS

AEPB	Abuja Environmental Protection Board
ASGM	Artisanal and Small-Scale Gold Mining
ATSDR	Agency for Toxic Substances and Disease Registry
BAN	Basel Action Network
BCCC-Africa	Basel Convention Coordinating Centre for the African Region
CASFU	Competent Authority – Seafood Unit (Ministry of Fisheries)
CMR	Central Motor Registry
CPC	Consumer Protection Council
Dip Con	Diplomatic Conference
DOC	D-Oiled Cake
DPR	Department of Petroleum Resources
EEE	Electrical and Electronic Equipment
EPA RfC.	Environmental Protection Agency Reference dose
FID	The Factory Inspectorate Division
FMARD	Federal Ministry of Agriculture and Rural Development
FMEnv	Federal Ministry of Environment
FMLE	Federal Ministry of Labour and Employment
FMITI	Federal Ministry of Industry, Trade and Investment
FMOH	Federal Ministry of Health
FRSC	Federal Road Safety Corp
GEF	Global Environment Facility
Hg	Mercury
ICCON	Institute of Chartered Chemist of Nigeria
IPAN	Institute of Public Analyst of Nigeria
LASEPA	Lagos State Environmental Protection Agency
LAWMA	Lagos State Waste Management Authority
LPFO	Low Pour Fuel Oil
MAN	Manufacturers' Association of Nigeria
MEAs	Multilateral Environmental Agreements
MIA	Minamata Initial Assessment
MMSD	Ministry of Mines and Steel Development
MTD	Motor Traffic Division
NAFDAC	National Agency for Food and Drug Administration and Control
NBS	National Bureau of Statistics
NCS	Nigerian Customs Service
NESREA	National Environmental Standards and Regulations Enforcement Agency
ng/m3	Nano-grams per cubic meter
NGO	Non-Governmental Organization
NIMASA	Nigerian Maritime Administration and Safety Agency

NOSDRA	National Oil Spill Detection and Response Agency
NPA	Nigerian Port Authority
NPC	National Population Commission
NPF	Nigerian Police Force
SAICM	Strategic Approach to International Chemicals Management
SON	Standards Organisation of Nigeria
SRADev	Sustainable Research and Action for Environmental Development
SWM	Solid Waste Management
t	Metric tonne
TCN	Transmission Company of Nigeria
TDU	Thermal Desorption Unit
TLS	Transfer Loading Station
UCH	University College Hospital
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
WEEE	Waste Electrical and Electronic Equipment

INTRODUCTION

Mercury as an Issue

Mercury, commonly known as quicksilver, is a chemical element with symbol Hg and atomic number 80. It is a dense, silver-white metal that is liquid at ordinary temperatures. It occurs in its elemental form in the the earth's crust but is more commonly found in the form of cinnabar, mercury sulphide (HgS). 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 volatilisation of the metallic mercury.

Liquid elemental mercury expands and contracts very precisely in response to changes in temperature and maintains its volume in response to change in atmospheric pressure. These unique properties have made it useful in devices designed to measure temperature or pressure.

As an element, mercury is persistent in the environment and is naturally released into the air as vapour during natural 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. It is clear that significant mercury is released from a range of human activities. It is now estimated that roughly 10% of the emissions of mercury to the atmosphere are from natural emissions from, for example, volcanoes; a further 30% is generated by current human activity; and the remaining 60% is re-emissions (evaporation, etc.) of mercury already in the environment, mostly as a result of previous human activity (UNEP, 2013a).

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, the breakage and improper disposal of mercury-containing products.

Once in the atmosphere mercury may cycle globally before deposition to land and water where it may be further transported, re-emitted to the atmosphere, or transformed by a variety of biological processes. This global transport of mercury means that even regions with no significant mercury releases, such as the Arctic, are known to be adversely affected by mercury.

There are three forms of mercury in the environment: elemental, inorganic, and organic mercury. Elemental mercury can combine with other elements to form inorganic mercury compounds (e.g. mercuric chloride, mercuric nitrate, mercuric oxide, mercuric sulphide etc). In addition, it may be subject to bio-transformation by aquatic microorganisms into the organic forms such as methyl mercury and ethyl mercury. Both organic and inorganic mercury compounds can also be synthesized technically.

Mercury is now present in various environmental media and food (especially some fish) all over the globe. Mercury bioaccumulates in natural food chains and this can result in concentrations in food resources at levels that adversely affect humans and wildlife. Furthermore, exposure to mercury may be enhanced where current or past economic activities have resulted in landfills, mine tailings, factory sites, soils and sediments contaminated with mercury.

Mercury is detrimental to human health, especially the developmental health of foetuses and young children, because of its toxicity to the nervous systems (brain and spinal cord). All the forms of mercury are toxic although the risk of intoxication to humans varies considerably as some forms are less bioavailable than others. High levels of methyl-mercury in the bloodstream of babies and young children may harm their ability to think and learn. Mercury also poses significant health risks in adults causing kidney, heart and respiratory problems, tremors, skin rashes, vision or hearing problems, headaches, weakness, memory problems, and emotional changes (Boening, 2000).

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 behavioral changes (Boening, 2000).

Mercury has been ranked third in the list of toxic substances (ATSDR 2012), being assessed as a toxic substance to ecosystem, wildlife and human (UNEP 2002 & 2013b). The toxic effects on humans, wildlife and the ecosystems cannot be overemphasized.

The Minamata Convention on Mercury

With UNEP's first Global Mercury Assessment (UNEP, 2002) came widespread recognition that the nature and behaviour of mercury in the environment, including its abilities for long-range transport in the atmosphere, its persistence, and its ability to bio-accumulate in the ecosystem leading to significant adverse effects on both human health and the environment, are of global concern requiring globally coordinated action (UNEP, 2013a).

Initially, UNEP was mandated by governments to coordinate actions, through a Global Mercury Partnership, to address the most pressing aspects of anthropogenic releases of mercury. Agreement to negotiate a legally-binding instrument to restrict anthropogenic releases was reached by the UNEP Governing Council in 2009 that requested UNEP to convene an Intergovernmental Negotiation Committee (INC) beginning in 2010. After a series of INC meetings, the treaty text was agreed by one hundred and forty-seven Governments on January 19, 2013 in Geneva, Switzerland, and the Convention was adopted and opened for country signatures 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, 2013c).

The overall objective of the Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds (UNEP 2013c). It was adopted to promote 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, and provides for the control and phasing out and or phasing down of Mercury and Mercury added products (UNEP, 2013).

As at 28 June 2017, 128 countries, including Nigeria, have signed the convention and 69 have ratified it. The convention will enter into force on the 16th August 2017.

Summary of Key Provisions of the Minamata Convention

The treaty sets out a series of obligations that Parties must address in order to comply with its key provisions. These are summarised as follows:

A. Supply and Trade

- New mercury mining is prohibited but existing extraction may continue for up to 15 years after the treaty become legally binding for a party.
- Mined mercury may only be used in permitted products and manufacturing processes, and should be disposed of in ways that do not lead to recovery, recycling, reclamation, direct re-use or alternative uses.
- Excess mercury from the decommissioning of chlor-alkali facilities cannot be re-used and parties should identify other major secondary sources and stockpiles of mercury.
- Mercury trades between parties can only take place after the importing party provides written prior informed consent.
- Parties can only export to non-parties that have measures in place to protect human health and the environment and follow treaty provisions on allowed uses, storage and disposal.
- Parties should only allow imports from non-parties proving guarantees that mercury comes from a source allowed under the treaty.

B. Products and Processes

- Parties should cease manufacturing, import, and export of listed mercury-added products by 2020.
- Dental amalgam is subject to restrictions with Parties required to take appropriate actions from a list of measures to ensure the phase-down of dental amalgam use.
- Parties should phase-out mercury use in certain listed industrial processes by 2018 and 2025 respectively,

and reduce mercury use in other listed industrial processes,.

- Parties may register time-limited exemptions from the phase-out dates providing an explanation of the need for the exemption.
- Parties should discourage the manufacture and commercial distribution of new mercury-added products and the development of new facilities that use mercury in manufacturing processes.

C. Artisanal and Small -Scale Gold Mining

- Parties should reduce and where feasible eliminate the use of mercury in, and the releases to the environment of mercury from ASGM mining and processing.
- Parties with "more than insignificant" ASGM and processing shall develop a national action plan outlining national objectives, reduction targets, and actions to eliminate whole ore amalgamation and open burning or amalgam as well as all burning of amalgam in residential areas.

D. Emissions and Releases

- Parties should require the use of BAT and BEP to new point sources of emissions in listed categories to control and where feasible reduce emissions no later than five years after the treaty enters into force.
- Parties should control and where feasible reduce emissions from existing point sources of listed categories through emissions limit values, BAT, BEP, or other alternative measures including co-benefits strategies, no later than 10 years after the treaty becomes legally binding.
- Parties should control and where feasible reduce mercury releases to land and water from point sources through BAT and BEP or alternative measures including multi-pollutant strategies.

E. Storage and Waste, Contaminated sites

- Parties shall ensure that mercury intended for an allowed use is stored in an environmentally sound manner.
- Parties shall ensure that mercury waste is managed in an environmentally sound manner, subject to recycling only for allowed uses or environmentally sound disposal, and transported across international boundaries only in accordance with the Basel Convention.
- Parties should develop strategies to identify and assess sites contaminated by mercury.

F. Health and public awareness, Reporting

- Parties are encouraged identify and protect populations at risk through the provision of education and prevention programmes and appropriate and enhanced health-care services.
- Parties should provide available information on mercury effects, use, alternatives and activities and promote education, training and public awareness related to the effects of mercury on human health and the environment.
- Parties are required to report to the Conference of the Parties, on the measures they have taken to implement the provisions of the treaty.

G. Resources and Compliance

- Financial resources to implement the treaty may include domestic, bilateral and multilateral funding as well as private sector investment. A mechanism to provide adequate, predictable and timely financial resources is defined and includes the GEF Trust Fund and a specific international programme to support capacity building and technical assistance.
- Parties shall cooperate to provide within their respective capabilities timely and appropriate capacity-building and technical assistance to developing country parties.
- A committee, established as a subsidiary body of the Conference of the Parties, is established to promote implementation of, and review compliance with, the treaty.

Mercury Initial Assessment

At its 44th Meeting in June 2013, the Global Environment Facility (GEF) Council considered document GEF/C.44/04, preparing the GEF to serve as an element of the financial mechanism of the Minamata Convention on Mercury upon its entry into force and in its decision, inter alia: "Authorized the use of up to $10 million for the funding of an early action pre-ratification program for the Minamata Convention to be programed during the remainder of GEF5 upon request by eligible signatory countries". The meeting also requested the GEF Secretariat to develop initial

guidelines consistent with the final resolutions of the Diplomatic Conference for enabling activities and pre-ratification projects, in consultation with the interim Secretariat of the Minamata Convention, and present this as an information document at the 45th Council Meeting.

The Minamata Convention Initial Assessment (MIA) was thus developed to enable countries to determine what is needed in order to ratify the Convention and, subsequently, to provide a basis for further work towards implementation. Initial guidelines for the MIA (Global Environment Facility, 2013) recommend that it contains the following components:

(a) Assessment of Legislation and policies in regard to the implementation of the provisions of
- Article 3. Mercury supply sources and trade.
- Article 4. Mercury added products.
- Article 5. Manufacturing process in which mercury or mercury compounds are used.
- Article 7. Artisanal and small-scale gold mining, including legislation and policy to cover formalization, worker health and safety.
- Article 8. Emissions, specifically in regard to relevant national air pollution/emission standards and regulations.
- Article 9. Releases, specifically in regard to the ability to identify and categorize sources of releases.
- Article 10. Environmentally sound interim storage of mercury other than waste mercury.
- Article 11. Mercury waste.

(b) 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, Artisanal Small Scale Gold mining (ASGM) and mercury added products.
- Trade in mercury and mercury containing compounds.

(c) Identification of:
- Emission sources of mercury.
- Release sources of mercury to land and water.

(d) 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

(e) Development of appropriate strategies for identifying and assessing mercury contaminated sites.

Based on the data generated from the implementation of the MIA, the MIA may also include the following:
- National mercury profile, including significant sources of emissions and releases, as well as inventories of mercury and mercury compounds.
- Overview of structures, institutions, legislation already available to implement the Convention.
- Challenges to implementation, including identification of legal and /or regulatory gaps to be addressed prior to ratification.
- Capacity building, technical assistance and well as other needs required for the implementation of the Convention.

Chapter 1.
NATIONAL BACKGROUND INFORMATION

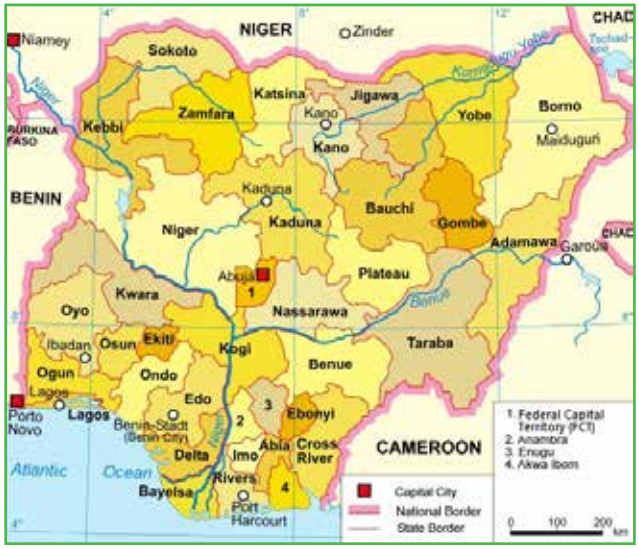


Figure 1: Map of the Federal Republic of Nigeria

1.1 Geography and Population

The Federal Republic of Nigeria is located on the west coast of Africa between latitudes 4.16 and 13.52 north and longitudes 2.40 and 14.32 east. It has a southern coastline of 853 km to the Gulf of Guinea of the Atlantic Ocean, and has borders with the Republics of Benin to the west, Niger to the north, Chad to the north-east, Cameroon to the east and south-east. The total area of 923,768 km2 comprises 910,768 km2 of land and 13,000 km2 of water.

The country has a humid sub-tropical climate, which is variable: equatorial in the south, tropical in the centre, and arid in the north. The River Niger which runs through the entire country enters the country in the northwest and flows southward through tropical rain forests and swamps to its delta in the Gulf of Guinea

The broad pattern of soil distribution in the country reflects both the climatic conditions and the geological structure: heavily leached, reddish brown, sandy soils are found in the south, and light or moderately leached, yellowish-brown, sandy soils in the north. The nutrient content of the soils is linked to the underlying geology. Over a large part of the northern and south western areas of the country, the geological structure is that of old crystalline basement complex rocks. These are highly mineralised and give rise to soils of high but variable nutrient status. On the sedimentary rocks found in the southeast, northeast and northwest of the country the soils are sandy and less variable but are deficient in plant nutrient. They are highly susceptible to erosion. The nature of the soil will also influence the environmental fate of mercury contamination in soils in different parts of the country.

The country's population is estimated at 182 million (National Population Commission, 2017). It is the most populous country in Africa. About seventy percent (70%) of the population is rural but the rate of urbanization is high with significant rural-urban migration. There are more than 500 spoken languages, and well over 250 ethnic groups, some numbering fewer than 10,000 people, while Hausa, Ibo and Yoruba are the major linguistic groups. English is the official language and lingua franca of the country.

A summary of country profile data for the Federal Republic of Nigeria is given in Table 1.

TABLE **1**

Summary of Country Profile Data for the Federal Republic of Nigeria

Capital	Abuja
Area	923,768 km2 (2014)
Land boundaries	4,047 km (Benin 652 km, Cameroon 773 km, Chad 87 km, Niger 1,497 km)
Coastline	853 km
Climate	Equatorial in the south, tropical in the centre, arid in the north. Natural gas, petroleum, tin, gold, iron ore, coal, limestone, niobium, lead, zinc
Land Use	Arable land: 33.02%, permanent crops: 3.14%; other: 63.84% (2005)
Irrigated land	2,820 km2 (2003)
Natural hazards	Periodic droughts; flooding
Environmental issues	Soil degradation; rapid deforestation; urban air and water pollution; desertification; chemical and hazardous waste pollution, oil pollution - water, air, and soil; loss of arable land; rapid urbanization
Geography note	The Niger River enters the country in the northwest and flows southward through tropical rain forests and swamps to its delta in the Gulf of Guinea
Population	182,200,000 (National Population Commission, 2017)
Administrative divisions	36 States and I Federal Capital Territory
Age structure	0-14 years: 42.79%, 15-24 years: 19.48%, 25-54 years: 30.65, 55-64 years: 3.96, 65 years and over: 3.1% (2016 est.)
Growth rate	2.7% (2010-2015)
Infant mortality	71.2 deaths/1,000 live births (2016 est.)
Life expectancy	52.6 years - female: 52.0- years male (2010-2015)
Fertility rate, total (live births per woman)	5.7 children born/woman (2010-2015)
Ethnic groups	More than 250 ethnic groups; Hausa and Fulani 29%, Yoruba 21%, Igbo (Ibo) 18%, Ijaw 10%, Kanuri 4%, Ibibio 3.5%, Tiv 2.5%
Religions	Christian, Muslim and indigenous beliefs
Languages	English (official), Hausa, Yoruba, Igbo (Ibo) fulfude
Literacy	Definition: age 15 and over can read and write, general rate of literacy is 59.6%, Male literacy rate is 69.2%, female literacy rate is 49.7%, Gender difference is 19.5%
Independence	1 October 1960 (from UK)
GDP	Purchasing power parity: $469 billion (2015 est.)
GDP real growth	4% (2015 est.)
GDP - per capita	Purchasing power parity - $6,400 (2015 est.)
GDP composition	Agriculture: 20.3%, industry: 23.6%, services: 56.1% (2015 est.)

1.2 Political and Economic Profile

After a long period of military rule, democratic governance has been restored since 1999. There is a 3-tier government system (National, State and Local Government). There are 36 States, a Federal Capital Territory (Abuja) and 774 Local Government Areas (L.G.A.s). The States and the Federal Capital Territory are grouped into 6 Geo-political zones namely North East, North West, North Central, South East, South West, and South-South.

The Federal Government of Nigeria comprises three distinct branches: executive, legislative and judicial. The executive branch is divided in Ministries, Departments and Statuary Agencies (MDAs). The National Assembly of Nigeria comprises the legislative branch. It has two chambers: the House of Representatives and the Senate. The House of Representatives is presided over by the Speaker of the House of Representatives. It has 360 members, who are elected for four-year terms in single-seat constituencies. The Senate, which has 109 members, is presided over by the President of the Senate. 108 members are elected for four-year terms in 36 three-seat constituencies, which correspond to the country's 36 states. One member is elected in the single-seat constituency of the federal capital. The judicial branch consists of the Supreme Court of Nigeria, the Court of Appeals, the High Courts, and other trial courts such as the Magistrates', Customary, Sharia and other specialised courts.

The approval of the three arms of the government is crucial in establishing a legal and institutional arrangement for the sound management of chemicals, including mercury.

Economic: Nigeria is the largest economy in Africa, with a GDP greater than USD 500 billion in 2015. The economy is driven primarily by the non-oil sectors, such as financial services, telecommunications, entertainment, etc. Foreign direct investment (FDI) inflows have been strong, averaging USD2 billion per quarter since 2013, with over 70percent of this in the non-oil sectors.

The major economic sectors include Oil and Gas, agriculture, industry, mining and quarrying, wholesale and retail trades. Insurance, banking and finance form the major part of the invisible trade.

Below the federal government there are 36 States, a Federal Capital Territory (Abuja). The states are further subdivided into 774 Local Government Areas (L.G.A.s) and grouped into 6 Geo-political zones namely North East, North West, North Central, South East, South West, and South-South respectively.

The country is well endowed with mineral resources including natural gas, petroleum, tin, iron, ore, coal, limestone, niobium, lead, and zinc. Whereas the oil and gas sector contributes about 90% of the country's foreign exchange earnings, agriculture is a major component of the country's non-oil sector, contributing on average 71.7% in 1992-94. Apart from food crops to boost national food security, the value of agricultural exports was 2.9% of total GDP during 1988-1992. Cocoa, oil palm, soybean, rubber, fish and shrimps, forest products and cotton are the main agricultural commodities boosting the country's agricultural exports. Hence there were fairly large agricultural pest and disease control activities involving the use of pesticides and other agents in the past.

The manufacturing sector is diverse with metallurgical, mineral, chemical and allied productions, including those processing and/or producing chlorine-containing chemicals, foundries, cement plants, power plants, as well as a few industrial incinerators for hazardous wastes.

1.3 Nigeria's Natural Resources

Nigeria is one of those countries in Africa that has a wide variety of different natural resources. The country is richly endowed with a variety of Natural Resources ranging from precious metals, various stones to industrial products such as Barites, Gypsum, Kaolin and Marble. Most of these are yet to be exploited.

TABLE **2**

Nigerian States and their Natural Resources

S/N	STATE	NATURAL RESOURCES
1	**Abia**	Gold, Lead/Zinc, Limestone, Oil/Gas & Salt
2	**Abuja**	Cassiterite, Clay, Dolomite, Gold, Lead/Zinc, Marble & Tantalite
3	**Adamawa**	Bentonite, Gypsium, Kaolin & Magnesite
4	**Akwa Ibom**	Clay, Lead/Zinc, Lignite, Limestone, Oil/Gas, Salt & Uranium
5	**Anambra**	Clay, Glass-Sand, Gypsium, Iron-ore, Lead/Zinc, Lignite, Limestone, Phosphate & Salt
6	**Bauchi**	Gold, Cassiterite (tine ore), Columbite, Gypsium, Wolfram, Coal, Limestone, Lignite, Iron-ore & Clay
7	**Bayelsa**	Glay, Gypsium, Lead/Zinc, Lignite, Limestone, Maganese, Oil/Gas & Uranium
8	**Benue**	Barite, Clay, Coal, Gemstone, Gypsium, Iron-Ore, Lead/Zinc, Limestone, Marble & Salt
9	**Borno**	Bentonite, Clay, Diatomite, Gypsium, Hydro-carbon, Kaolin & Limestone
10	**Cross River**	Barite, Lead/Zinc, Lignite, Limestone, Manganese, Oil/Gas, Salt & Uranium
11	**Delta**	Clay, Glass-sand, Gypsium, Iron-ore, Kaolin, Lignite, Marble & Oil/Gas
12	**Ebonyi**	Gold, Lead/Zinc & Salt
13	**Edo**	Bitumen, Clay Dolomite, Phosphate, Glass-sand, Gold, Gypsium,Iron-ore, Lignite, Limestone, Marble & Oil/Gas
14	**Ekiti**	Feldspar, Granite, Kaolin, Syenite & Tatium
15	**Enugu**	Coal, Lead/Zinc & Limestone
16	**Gombe**	Gemstone & Gypsium
17	**Imo**	Gypsium, Lead/Zinc, Lignite, Limestone, Marcasite, Oil/Gas, Phosphate & Salt
18	**Jigawa**	Butyles
19	**Kaduna**	Amethyst, Aqua Marine, Asbestos, Clay, Flosper, Gemstone, Gold, Graphite, Kaolin, Hyanite, Mica, Rock Crystal, Ruby, Sapphire, Sihnite, Superntinite, Tentalime, Topaz & Tourmaline
20	**Kano**	Gassiterite, Copper, Gemstone, Glass-sand, Lead/Zinc, Pyrochinre & Tantalite
21	**Katsina**	Kaolin, Marble & Salt
22	**Kebbi**	Gold
23	**Kogi**	Coal, Dolomite, Feldspar, Gypsium, Iron-ore, Kaolin, Marble, Talc & Tantalite
24	**Kwara**	Cassiterite, Columbite, Feldspar, Gold, Iron-ore, Marble, Mica & Tantalite
25	**Lagos**	Bitumen, Clay & Glass-sand, Oil and Gas
26	**Nasarawa**	Amethyst (Topaz Garnet), Barytex, Barite, Cassirite, Chalcopyrite, Clay, Columbite, Coking Coal, Dolomite/Marble, Feldspar, Galena, Iron-ore, Limstone, Mica, Salt, Sapphire, Talc, Tantalite, Tourmaline Quartz & Zireon
27	**Niger**	Gold, Lead/Zinc & Talc
28	**Ogun**	Bitumen, Clay, Feldspar, Gemstone, Kaolin, Limestone & Phosphate
29	**Ondo**	Bitumen, Clay, Coal, Dimension Stones, Feldspar, Gemstone, Glass-Sand, Granite, Gypsium, Kaolin, Limestone & Oil/Gas
30	**Osun**	Columbite, Gold, Granite, Talc, Tantalite & Tourmaline
31	**Oyo**	Aqua Marine, Cassiterite, Clay, Dolomite, Gemstone, Gold, Kaolin, Marble, Silimonite, Talc & Tantalite
32	**Plateau**	Barite, Bauxite, Betonite, Bismuth, Cassiterite, Clay, Coal, Emeral, Fluoride, Gemstone, Granite, Iron-ore, Kaolin,Lead/Zinc, Marble, Molybdenite, Phrochlore, Salt, Tantalite/Columbite, Tin & Wolfram
33	**Rivers**	Clay, Glass-Sand, Lignite, Marble & Oil/Gas

S/N	STATE	NATURAL RESOURCES
34	**Sokoto**	Clay, Flakes, Gold, Granite, Gypsium, Kaolin, Laterite, Limestone, Phosphate, Potash, Silica Sand & Salt
35	**Taraba**	Lead/Zinc
36	**Yobe**	Soda Ash & Tintomite
37	**Zamfara**	Coal, Cotton & Gold

Institutional and regulatory frameworks on environmental protection and natural resources conser-vation were put in place in 1988 through the establishment of the Federal Environmental Protection Agency (FEPA) by Act 58 of 1988. FEPA became the Federal Ministry of Environment, (FMEnv) in 1999. FMEnv was established as a legal entity by the President of the Federal Republic of Nigeria to ensure effective coordination of all environmental matters, which hitherto were fragmented and resident in different line Ministries. The mandates of the Ministry described in more detail in Chapter 3.

1.4 Profile of Solid Mineral Deposits in Nigeria

Nigeria is endowed with a large variety of solid minerals in commercial quantities and up to thirty-three different solid minerals have been identified (FMITI). Some of these are discussed below:

a. Gold
There are proven reserves of both alluvial and primary gold in the schist belt of Nigeria located in the south-western part of the country. The deposits are mainly alluvial and are currently being exploited majorly on a small scale.

b. Iron Ore
There are over 3 billion metric tonnes of iron ore in deposits found in Kogi, Enugu and Niger States as well as the Federal Capital Territory. Iron Ore is being mined at Itakpe in Kogi State and about 67 percent of iron are already being beneficiated.
The Aladja and Ajaokuta Steel complexes are ready for consumer of billets and other iron products for down-stream industries.

c. Bitumen
The occurrence of bitumen deposits in Nigeria is indicated at about 42 billion tonnes; almost twice the amount of existing reserves of crude petroleum. Analytical results suggest that this potential resource can be used directly as an asphalt binder. Most bitumen used for road construction in Nigeria is currently imported.

d. Coal
There are nearly 3 billion tonnes of indicated reserves in 17 identified coal fields and over 600 million tonnes of proven reserves.

e. Rock Salt
The national annual demand for table salt, caustic soda, chlorine, sodium bicarbonate, sodium hydrochloric acid and hydrogen peroxide exceeds one million tonnes. There are salt springs at Awe (Plateau State), Abakaliki and Uburu (Ebonyi State), while rock salt is available in Benue State.
A total reserve of 1.5 million tonnes has been indicated, and further investigations are now being carried out by Government.

f. Gemstones
Gemstones mining has boomed in various parts of Plateau, Kaduna and Bauchi states for years. Some of

these gemstones include sapphire, ruby, aquamarine, emerald, tourmaline, topaz, garnet, amethyst; zircon, and fluorspar.

g. Talc

Over 40 million tonnes deposits of talc have been identified in Niger, Osun, Kogi, Ogun and Kaduna states. The Raw Materials Research and Development Council (RMRDC)'s 3,000 tonnes per annum catalytic Talc plant in Niger state is the only talc plant in the country.

h. Gypsum

Gypsum is an important input for the production of cement. It is also used for the production of Plaster of Paris (P.O.P) and classroom chalks. A strategy for large-scale mining of gypsum is urgently required to sustain the existing plants and meet the future expansion. Currently, cement production is put at 38 million tonnes per annum while the national requirement is more than the current production rate. About one billion tonnes of gypsum deposits are spread over many states in Nigeria.

i. Lead/Zinc

An estimated 10 million tonnes of lead/zinc veins are spread over eight states of Nigeria. Proven reserves in three prospects in the east-central area are 5 million tonnes. Joint venture partners are encouraged to develop and exploit the various lead/zinc deposits all over the country.

j. Bentonite and Baryte

These are the main constituents of the mud used in the drilling of all types of oil wells. The Nigerian baryte has specific gravity of about 4.3. Over 7.5 million tonnes of baryte have been identified in Taraba and Bauchi States. Large bentonite reserves of 700 million tonnes are available in many states of the federation ready for massive development and exploitation.

k. Kaolin

An estimated reserve of 3 billion tonnes of good kaolinitic clay has been identified in many localities in Nigeria.

1.5 Country Environmental Overview

Major environmental challenges facing the country are soil degradation, rapid deforestation, urban air and water pollution, desertification, chemical and oil pollution (water, air, and soil; serious ecological damage from oil spills), loss of arable land and rapid urbanization accompanied by unsustainable waste management. Uncontrolled open burning of solid wastes is the rule rather than the exception which, although convenient, is environmentally unacceptable.

A number of areas of concern where improvements are urgently required are: pollution of inland waterways, air pollution, soil contamination, impact of chemicals on public health, occupational health, drinking water contamination, hazardous chemicals imports, treatment of hazardous waste and emergency preparedness, enactment of comprehensive National Chemicals Legislation, Capacity Building, awareness creation, Technical and Financial Resources (Nigeria National Chemical Profile Report 1999).

The country is a party to the following Multilateral Environmental Agreements (MEAs) listed in Table 3 below and is also an active participant in the voluntary global initiatives and policy frameworks listed in Table 4:

TABLE **3**

List of Multilateral Environmental Agreements for which Nigeria is a Party

Date of Enforcement	Date Signed	Title of Treaty or Convention
24/2/04	1998	Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
22/08/04	2001	Stockholm Convention on Persistent Organic Pollutants (POPs)
10/4/96		Amendment to the Montreal Protocol on Substances that deplete the Ozone Layer
13/5/95		International Convention on Oil Pollution Preparedness, Response and Co operation
27/11/94	13/6/92	Framework Convention on Climate Change
27/11/94	13/6/92	Convention on Biological Diversity (Rio Conference)
16/11/94	10/12/82	United Nations Convention on the Law of the Sea
05/5/92	15/3/90	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
		Bamako Convention on the ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa
	10/10/2013	Minamata Convention on Mercury
29/1/89		Protocol on Substances that deplete the Ozone Layer (Montreal Protocol)
29/1/89		Convention for the Protection of the Ozone Layer (Vienna Convention)
10/12/87		International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage
01/1/87		Convention on the Conservation of Migratory Species of Wild Animals
05/8/84	23/5/81	Convention for Co operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region
05/8/84	23/5/81	Protocol concerning Co operation in combating Pollution in cases of Emergency
05/8/81		International Convention on Civil Liability for Oil Pollution Damage
27/1/80	23/5/69	Vienna Convention on the Law of Treaties
11/3/79		Amendments to Annexes to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter concerning Incineration at Sea
18/4/76		Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
17/12/75		Convention concerning the Protection of the World Cultural and Natural Heritage
01/7/75	11/2/74	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
30/10/94	08/7/97	Desertification Convention
07/6/74	15/9/68	African Convention on the Conservation of Nature and Natural Resources
28/5/71		Convention on the Continental Shelf
22/4/68		International Convention for the Prevention of Pollution of the Sea by Oil,1954, as amended in 1962 and 1969
17/2/67	02/9/63	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water
28/2/66		International Convention for the Safety of Life at Sea
20/3/66		Convention on Fishing and Conservation of the Living Resources of the High Seas
10/9/64		Convention on the Territorial Sea and the Contiguous Zone
13/4/63		Convention on the African Migratory Locust
30/9/62		Convention on the High Seas

Date of Enforcement	Date Signed	Title of Treaty or Convention
03/12/77	03/12/77	Agreement on the Joint Regulations on Fauna and Flora
15/7/77		Convention on the International Regulations for Preventing Collisions at Sea
13/2/85		Protocol relating to the International Convention for the Safety of Life at Sea (SOLAS Prot.)
07/8/81		International Convention for the Safety of Life at Sea (SOLAS)
29/10/93		International Covenant on Civil and Political Rights
07/2/68		Convention and Statute on the Regime of Navigable Waterways of International Concern
15/6/70		Convention on the Recognition and Enforcement of Foreign Arbitral Awards
04/5/67	04/5/67	Articles of Association for the establishment of an Economic Community of West Africa
10/9/64		Agreement establishing the African Development Bank
29/10/64		Statute of the International Institute for the Unification of Private Law
15/10/68		Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare
30/3/61	30/3/61	Agreement of the International Bank for Reconstruction and Development
14/11/67		Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies
05/3/70	01/7/68	Treaty on the Non Proliferation of Nuclear Weapons
26/2/73	03/5/68	Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects launched into Outer Space
26/3/75	03/7/72	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction
14/11/60	02/11/60	Constitution of the United Nations Educational, Scientific and Cultural Organization
17/10/60		Constitution of the International Labour Organization
25/3/64		Statute of the International Atomic Energy Agency
14/12/60		Convention on International Civil Aviation Annex 16 Aircraft Noise
30/12/60		Convention of the World Meteorological Organization
07/10/60		Charter of the United Nations
15/3/60		Convention on the International Maritime Organization
06/3/64		Agreement concerning the voluntary contributions to be given for the execution of the project to save the Abu Simbel Temples
01/2/66		Act regarding Navigation and Economic Co- operation between the States of the Niger Basin
12/4/66		Agreement concerning the River Niger Commission and the Navigation and Transport on the River Niger
07/5/64		International Convention on Certain Rules concerning Civil Jurisdiction in Matters of Collision
24/1/72		Agreement concerning the Voluntary Contributions to be given for the Execution of the Project to save the Temples of Philae
25/11/60	25/11/60	Constitution of the World Health Organization
11/10/60		Constitution of the Food and Agriculture Organization of the United Nations
14/11/61		Articles of Agreement of the International Development Association
30/3/61	30/3/61	Agreement of the International Monetary Fund
14/11/63		Charter of the Organization of African Unity
01/10/60		General Agreement on Tariffs and Trade

Date of Enforcement	Date Signed	Title of Treaty or Convention
12/12/61		Statutes of the International Centre for the Study of the Preservation and Restoration of Cultural Property
13/2/85		International Convention on Standards of Training, Certification and Watch keeping for Seafarers
11/3/81		Amendments to the Annexes to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
03/12/82	21/11/80	Convention Creating the Niger Basin Authority
03/12/82	21/11/80	Protocol relating to the Development Fund of the Niger Basin
01/11/92		Convention of the Carriage of Goods by Sea
08/12/84		Third ACP EEC Convention
10/9/90	21/1/87	Convention on Early Notification of a Nuclear Accident
10/9/90		Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
10/4/89	21/1/87	Protocol Additional to the Geneva Conventions of 12 August 1949 and relating to the Protection of Victims of International Armed Conflicts (Protocol I)
10/4/89		Protocol Additional to the Geneva Conventions relating to the Protection of Victims of Non International Armed Conflicts (Protocol II)
14/7/96	28/4/89	International Convention on Salvage
13/4/87		Amendment to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (art.XI)
15/12/89		Fourth ACP EEC Convention
03/6/91		Treaty establishing the African Economic Community
13/1/93		Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and their Destruction
21/6/85	08/4/79	Constitution of the United Nations Industrial Development Organization
26/12/96	31/10/94	International Convention to combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa
21/9/94		Convention on Nuclear Safety
28/7/96	25/10/94	Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982

TABLE **4**

Voluntary Global Initiatives and Policy Frameworks Adopted

1.	Globally Harmonized System (GHS) for Classification and labeling of Chemicals (2003), Globally Harmonized System (GHS) for Classification and labeling of Chemicals (2003),
2.	Strategic Approach to International Chemicals Management (SAICM), 2006.

Institutional and regulatory frameworks on environmental protection and natural resources conservation were put in place in 1988 through the establishment of the Federal Environmental Protection Agency (FEPA) by Act 58 of 1988. FEPA became the Federal Ministry of Environment, (FMEnv) in 1999. FMEnv was established as a legal entity by the President of the Federal Republic of Nigeria to ensure effective coordination of all environmental matters, which hitherto were fragmented and resident in different line Ministries. The mandates of the Ministry are described in more detail in Chapter 3.

1.6 Nigeria's MIA Project

The National GEF project on "Minamata Convention Initial Assessment in Nigeria" was approved by the GEF Council in 2014. The project was developed with the assistance of the United Nations Industrial Development Organization (UNIDO), as the Implementing Agency for the GEF, with the Federal Ministry of Environment (FMEnv) and the United Nations Institute for Training and Research (UNITAR) as the co-executing agencies.

Project implementation began in 2015 with the identification of a Project Team, comprising a Project Coordinator and technical officers, and the establishment of a National Project office for effective coordination throughout project lifecycle.

The following outputs are to be delivered during the project:

Output 1: Project coordination mechanism and identification of institutional gaps.

Output 2: Review of existing mercury related regulations and identification of needed policy reforms to prepare for implementation of the Minamata Convention.

Output 3: Establishing National mercury profile based on initial inventory and key sectors identified for intervention and investment to reduce and where possible, eliminate, mercury use, release, and emissions

Output 4: Dissemination of information among relevant stakeholder groups (academia, public and private sectors, and civil society)

The MIA project activities are targeted towards understanding the national situation with regard to mercury, in particular, in relation to the relevant articles of the Minamata Convention on Mercury (Table 4). Activities include assessing patterns of mercury consumption and release, in order to facilitate the design of targeted interventions, and assessing national regulatory and institutional capacities to identify the institutional needs to implement the treaty at national level. The outcome of the project will boost the country's efforts significantly to reduce mercury releases and so to reduce the risks of exposure of mercury so benefitting human health and the environment. These will, in turn, provide local and global benefits through reduced mercury releases to the environment.

TABLE **5**

Relevant Articles of the Minamata Convention on Mercury for National Consideration

Relevant Article	Description of Article and Relevance to Nigeria
Article 3: Supply and trade	Relevant to Nigeria is the part on providing written consent in export and import.
Article 4: Mercury-added products	**Prohibit** the manufacture, import and export of mercury-added products. Part I: To be phased out by 2020 (Batteries, Switches and relays, Compact fluorescent lamps (CFLs), High pressure mercury vapour lamps (HPMV), Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL), Cosmetics including skin lightening soaps and creams; Pesticides, biocides and topical antiseptics; non-electronic measuring devices such as barometers; hygrometers; manometers; thermometers; sphygmomanometers. **Part II:** Phase Down the use of Dental Amalgam by implementing 2 or more of 9 proposed measures Relevant to Nigeria as an importer and user of products that may contain mercury, including dental amalgam, and as a final destination for such products at or near end-of-life.
Article 7: Artisanal and small-scale gold mining	Parties with ASGM to take steps to reduce and where feasible eliminate the use of mercury in such mining and its release to the environment from mining and processing. To notify the secretariat where ASGM is more than insignificant To develop and implement a national action plan (in accordance with Annex C). Relevant to Nigeria as a country with a sizeable ASGM community
Article 8: Emissions	A Party with relevant sources shall take measures to control releases and may prepare a national plan setting out such measures and their expected targets, goals and outcomes. Implement 1 or more of 5 measures as soon as practicable but no more than 10 years after entry into force. Require the use of BAT/BEP for any new sources, no later than 5 years after entry into force. Develop and maintain an inventory of emissions from relevant sources. Point sources are defined in Annex D of the Convention as: Coal-fired power plants; coal-fired industrial boilers; Smelting and roaring processes used in the production of non-ferrous metals (lead, zinc, copper, industrial gold); Waste incineration facilities; Cement clinker production facilities. Relevant to Nigeria as host to several of the source categories listed in Annex D
Article 9: Releases	Controlling and, where feasible, reducing releases of mercury and mercury compounds to land and water from the relevant point sources not addressed in other provisions of the Convention. Parties to identify the relevant point source categories and may prepare a national plan setting out measures, as listed in paragraph 5, to be taken to control releases and its expected targets, goals and outcomes. Plan to be submitted to the COP within 4 years of entry into force. Relevant to Nigeria as host to potential sources of releases
Article 10: Environmentally sound interim storage of mercury, other than waste mercury	Each Party shall take measures to ensure that the interim storage of mercury and mercury compounds intended for a use allowed to a Party under this Convention is undertaken in an environmentally sound manner, taking into account any guidelines, and in accordance with any requirements, adopted pursuant to paragraph 3. Relevance to Nigeria to be clarified during identification of industries potentially using mercury

Relevant Article	Description of Article and Relevance to Nigeria
Article 11: Mercury wastes	Each Party shall take appropriate measures so that mercury waste is: • Managed in an environmentally sound manner, taking into account the guidelines developed under the Basel Convention and in accordance with requirements of the COP • Only recovered, recycled, reclaimed or directly re-used for a use allowed to a Party under this Convention or for environmentally sound disposal pursuant to paragraph 3 (a); • For Parties to the Basel Convention, not transported across international boundaries except for the purpose of environmentally sound disposal in conformity with this Article and with that Convention Relevant to Nigeria in respect of mercury-added products at end of life and of potentially contaminated wastes imported for treatment and disposal
Article 12: Contaminated sites	Each party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds. Relevant to Nigeria with regard to potentially contaminated sites related to current or previous industrial and mining activity and of waste disposal
Article 16: Health aspects	Parties encouraged to • promote the development and implementation of strategies and programmes to identify and protect populations at risks; • develop and implement science-based educational and preventive programmes on occupational exposure; • promote appropriate health-care services for prevention, treatment and care; • strengthen institutional and health professional capacities for prevention, diagnosis, treatment and monitoring Relevant to Nigeria given known health impacts within ASGM communities and potential impacts in other industries including waste management and disposal.
Article 18: Public information, awareness and education	Each Party to promote and facilitate: • provision to the public of available information relating to the use, substitution, release sources, health and environmental effects of mercury and mercury compounds, alternatives to them; • education, training and public awareness related to the effects of exposure to mercury and mercury compounds; • to consider use of existing mechanisms or developing mechanisms, such as pollutant release and transfer registers (PRTR) for the collection and dissemination of information on estimates of emissions, releases and disposals. Relevant to Nigeria as part of actions to reduce and, where possible, eliminate mercury use and to improve behaviour in managing materials and wastes containing or contaminated by mercury.
Article 19: Research, development and monitoring	Parties to cooperate to develop and improve • inventories of use, consumption and anthropogenic emissions and releases • modelling and geographically representative monitoring of mercury in human and environmental media • assessment of impacts • harmonised methodologies • information on the environmental cycle, transport, transformation and fate of mercury Relevant to Nigeria to build relevant information resources and to strengthen scientific capacities in mercury monitoring, including as part of global initiatives.

Chapter 2.
MERCURY INVENTORY AND IDENTIFICATION OF EMISSIONS AND RELEASES IN NIGERIA

2.1 Inventory Planning, Preparation and Management

The inventory of mercury emissions and releases in Nigeria was undertaken using the UNEP's Toolkit for Identification and Quantification of Mercury Releases Level 1 (IL1) and Level 2 (IL2). (UNEnvironment, 2017). The following preparatory activities were undertaken to ensure a successful inventory:

Seven **Sectoral Working Groups** were established by FMEnv in June 2015 for the inventory of mercury emission and releases in Nigeria. The working groups and their membership, including relevant stakeholders, are set out in Table 6 below:

TABLE **6**

Inventory Working Groups

SECTOR	MEMBERS
Supply and Storage	FMEnv, NAFDAC, FMITI, NBS
Energy	Federal Ministry of Power, Works and Housing, Transmission Company of Nigeria (TCN) Nigerian National Petroleum Corporation (NNPC), NLNG,NOSDRA, NBS
Mercury Added Products	FMOH, SRADEV Nigeria, NBS
Industrial Process	FMITI, NESREA ,MMSD, NBS
ASGM	MMSD, NESREA
Waste Management	FMEnv, NESREA, LAWMA, AEPB, NBS
Crematoria	FMEnv, LAWMA

A three day **mercury inventory training workshop** on the use of the UNEP's toolkit for Identification and Quantification of mercury releases was organized for the working group members in-order to build their capacity on the toolkit and data-gathering techniques. The training was attended by 26 participants from FMEnv, FMOH, FMITI, MMSD, NESREA, NOSDRA, NAFDAC, MAN, NBS, TCN, LAWMA, and from academia and NGOs.

The training was conducted by Mr. Carson Larson from COWI Denmark. Also present were UNIDO, represented by Mr. Oluyomi Banjo, and UNITAR, represented by Mr. Jorge Ocana and Mr. Nelson Manda, to provide necessary support and guidance.

Figure 2: Mr. Carson Larson (COWI) delivering an introduction on "the Toolkit for identification and quantification of mercury releases"

Figure 3: Group work at the inventory training workshop

The **collection, collation and verification of data** for the inventory commenced in June 2016 after the completion of the mercury inventory training. The strategies applied include the following:

- Desktop data gathering.
- Development and circulation of questionnaires to all relevant sectors/stakeholders with an indication of deadline for submission of completed questionnaires.
- Collection of data and information from stakeholders and relevant sources.
- Compilation and collation of data/information received.
- Documentation of sources and validation of the accuracy of data/information to resolve inconsistencies.
- Identification of issues, problems, or opportunities and determining if site visits are needed.
- Completion of data analyses and verifications.
- Input of data to Levels 1 and 2 of the UNEP Toolkit for the identification and quantification of mercury releases
- Interpretation of data and toolkit results, preparation of conclusions.

Site visits were conducted for priority sectors covering the six geopolitical zones, selected on the basis of type, location and potential risks. The focus of the site visits was to conduct on-the-spot assessments and gathering of further relevant information.

2.2 Sources of Mercury Emissions and Releases in Nigeria

Mercury is emitted and released through the economic activities of the following sectors in Nigeria:

- Production, importation, use, wear and tear and disposal of mercury-added products
- Artisanal and small-scale gold mining (ASGM);
- Coal-fired power plants and industrial boilers;
- Smelting and roasting processes used in non-ferrous metal production
- Cement clinker production;
- Industrial fugitive emissions;
- Waste Management;
- Oil & Gas exploration and exploitation activities;
- Contaminated sites

2.2.1 Mercury-added Products

The Minamata Convention on Mercury defines a mercury-added product as "a product or product component that contains mercury or a mercury compound that was intentionally added". Annex A part I of the Convention lists those mercury-added products subject to prohibition of manufacture, import or export after the phase-out date specified while part II of the annex sets out specific provisions that Parties to

the Convention shall take with regard to the products listed there.

Mercury-added products listed in Part I of Annex A include certain batteries; switches and relays; certain lighting products including particular types of fluorescent lamps and mercury vapour lamps; cosmetics with mercury content > 1 ppm; pesticides, biocides and topical antiseptics; non-electronic measuring devices such as barometers, hygrometers, manometers, thermometers and sphygmomanometers. Mercury-added products listed in Part II of Annex A are currently limited to dental amalgam. Mercury is primarily released to the environment when these products are manufactured, broken during use, and disposed of.

Mercury-added products include both manufactured and formulated products:

- A *manufactured* product is a combination of individual components, one or more of which has mercury added, that combine to make a single product. These equipment categories include: measuring devices, thermostats, switches and relays, lamps, batteries, etc. These are likely to be found in Nigeria and will need to be regulated according to the Minamata Convention on Mercury. While there is no known local manufacturing of any of these products, some data exist on importers, and the quantities imported. These product categories are discussed in detail below.
- A *formulated product* is a product comprising a consistent mixture of chemical components that together form a particular function. Formulated products include, but are not limited to, pharmaceuticals and cosmetics, agrochemicals, cleaning products, and coating materials. Formulation or re-formulation of these products is known to take place locally in Nigeria in both the formal and informal sectors. Some of these products are known to be in the market through regulated and unregulated (illegal) processes.

Tables 7 and 8 below show typical values for mercury in a range of manufactured and formulated mercury-added products.

TABLE **7**

Manufactured Mercury-added Components and Products

Component or Product	Amountof Mercury in Individual Component or Product (grams)
Measuring devices:	
Barometers	400 – 620
Sphygmomanometers	50 – 140
Manometers	30 – 75
Psychrometers	5 – 6
Thermometers	0.5 – 54
Switches & Relays:	
Flame Sensors	>1
Float Switches	0.1 – 70
Tilt Switches	0.05 – 5
Relays	0.005 - >1
Dental Amalgam	>0.1 – 1
Lamps:	
Fluorescent	<0.10
Compact Fluorescent	<0.01
High Intensity Discharge (metal halide, ceramic metal halide, mercury vapor, high pressure sodium)	<1
Mercury Short Arc	0.1 – 1
Button-cell Batteries	<0.05

Source: Galligan et al.,2003

TABLE **8**

Formulated Mercury-added Products

Component or Product	Amountof Mercury in Individual Component or Product (ppm)
Preservatives & Reagents	>0 - >250
Mercury Compounds	>0 - >250

Source: Galligan et al, 2003, SRADEV, 2014

A preliminary mercury assessment on mercury-added products in Nigeria conducted by the FMEnv and relevant organizations revealed estimated that over 810 million items of mercury-added products are imported into Nigeria from over 71 countries (FMEnv, 2017).

Batteries

The major types of the batteries containing mercury include zinc air, mercuric oxide, silver oxide and some alkaline manganese batteries. Table 9 below shows the countries that exported the products into Nigeria and the respective quantities shipped.

Inventory undertaken by the FMEnv indicates that a total of 37,765 tonnes of batteries were imported into the country in 2013. Imports came from 22 countries but supply is dominated by China that provided about 91% of the batteries imported. It is noteworthy that Africa countries such as Egypt, Congo, and Ghana also export batteries into Nigeria but it is unclear whether these are from manufacturing in those countries or from stocks previously imported to them.

TABLE **9**

Countries that Export Battery Products to Nigeria

Country	Africa	Armenia	Belgium	Czech Republic	Canada	China	Congo Bazerville	Denmark	Egypt	France	Ghana	Germany
Country	Haiti	Hong Kong	India	Indonesia	Israel	Italy	Japan	Korea	South Africa	Singapore	Slovakia	Spain
Country	Sweden	Switzerland	Taiwan	Thailand	Turkey	UAE	U.K	United States				

Source: (NCS, 2013-2014)

The highest quantified input of mercury with batteries is from ***mercury oxide batteries***, which are specialty batteries with a very high concentration of mercury (generally around 31% of the battery weight). A quantity of 78 t/y of mercury oxide batteries was reported and used in the calculations.

As this is a very high number even for a large country like Nigeria, a deeper analysis of import/export data from UN Comtrade was performed. The analysis revealed very fluctuating data with an outlier of a massive net export in 2014 (no newer data were reported). The calculated average net import for the years 2011-2013 was about 61 t/y, whereas including the 2014 outlier gave a net export of about 102 t/y for the period 2011-2014 (estimated based on value and net weight). Even with the high numbers reported, this is a question of a few small shipments, and such numbers are very vulnerable to imprecise or missing reporting to the customs. The available data do not allow a closer investigation of the consumption of mercury oxide batteries. Judged from experience in other countries, the real consumption of mercury with mercury oxide batteries is likely to be lower than estimated here.

Another high contribution of mercury is from general alkaline batteries. With the high consumption numbers, the reported trade numbers may be reliable. Here, the uncertainty is primarily caused by the lack of knowledge about the mercury concentrations in batteries on the African market: while major globally

traded brands often have no added mercury, cheaper regionally traded brands may still contain mercury. As consumption is probably a mix of these two groups, the calculated mercury input may be an overestimate.

Switches and relays

Mercury has traditionally been used in a great variety of electrical switches, relays, arc rectifiers and thermostats. These components have been used in a variety of electrical and electronic equipment and vehicles.

In Nigeria, switches, relays, lamps and other electrical equipment products constitute over 60% of the total mercury-added products imported into Nigeria (NCS information). They typically comprise components of near-end-of-life electronic products and second-hand cars that continue to be imported into the country with little or no end-of-life management control. While the mercury content of individual products is not high, the sheer volume of import, sales, application and disposal of these products means that there may be significant mercury release into air, water, land, and general waste.

The estimated mercury input to the inventory from electrical switches and relays with mercury is 13,009 kgHg/y and is estimated from the Nigerian population of 182,200,000.

Mercury tilt switches are small tubes with electrical contacts at one end of the tube. As the tube tilts, the mercury collects at the lower end, providing a conductive path to complete the circuit. Mercury tilt switches are used for the following applications:

- Some medical devices and laboratory equipment like x-ray machines;
- Motion/vibration sensors;
- Float switches and level switches;
- Lifeboats;
- Thermostats.

The tilt switches typically contain from 0.5g to 10g mercury per switch.

Motion/vibration sensors are very similar in design to tilt switches. Applications of vibration sensors include anti-theft devices, man-down alarms to detect non motion, smart appliances to turn off power when not in use and portable equipment to do the same. There are two basic types of float switches:

Float switches located in a buoyant float housing and actuated by rising and falling liquid levels;

Stationary float switches that are actuated by the presence or absence of liquid (level detectors).

- Float switches are used for liquid monitoring and control of the liquid level in tanks, wells, chambers, drillings, and other containers. Float switches are used to actuate alarm and control circuits monitoring various liquids including, among others, water, sewage, wet sludge, oil etc. Electrical switches are used as spare parts for personal motion alarms which emit a radio signal indicating that the person is immobile if no change in position takes place within a certain period (Kemi, 2004). Position safety switches are also used in certain X-ray equipment.

Thermoregulators (as known as contact thermometers or accustats) provide a constant temperature in baths, ovens, incubators, circulating systems, alarm circuits, petroleum and asphalt testing etc.

Mercury wetted switches and relays are electrically controlled devices that open or close electrical contacts to effect the operation of other devices in the same or another electrical circuit. Relays are often used to switch large current loads by supplying relatively small currents to a control circuit. A mercury wetted reed relay is a type of electro-mechanical relay that employs a hermetically sealed mercury reed switch. Reed relays are primarily used in test, calibration, and measurement equipment applications where stable contact resistance over the life of the product is necessary.

The mercury content of the reed switches varies among the different types. From manufacturers information of mercury reed switches, the mercury content of 5 basic types of mercury reed switches is as follows: HG switch (3g Hg), HGW switch (0.32g), HGX switch (0.071g), MH4 switch (0.041g) and MH5 switch (0.0095) (Comus 2008b).

Mercury displacement relays and contactors have been used in high-current, high-voltage applications such as industrial process controllers, power supply switching, resistance heating, tungsten lighting, welding, high current/voltage lighting, flood lights, copiers, battery chargers, energy management systems, and industrial ovens. The mercury content reported by manufacturers of relays is in the range of 1g and above.

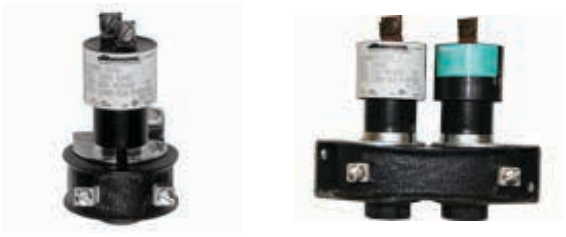


Figure 4: Photos of Examples of BB and BB2 mercury contactors

Mercury pressure switches typically use a piston, diaphragm, or bellows acting as the pressure sensor to actuate the mercury switch. In many applications, such switches have been replaced by mercury free digital and mechanical switches but they may still be found in older equipment or in specialist applications. They are widely reported to have applications in:

- Heating, ventilation, and air conditioning: electrostatic air cleaners, filter indicators, reserve oil level, gas-fired heating, ventilation, utility heaters, heat pumps, furnaces, flue gas, fuel delivery, etc.
- Medical: respiratory sensors, therapy tent nebulizers, automated blood pressure systems, sip-and-puff movement controls, anesthesia leak detection, saline pumps, tourniquet systems, reverse osmosis purification systems, dental aspirator pumps, respiratory therapy, disposable surgical vacuum systems, etc.
- Appliance: floor scrubbers, vacuum cleaners, food storage sealers, air conditioners, hot water dispensers, hot water heaters, etc.
- Other: venting hoods, tape braking systems, tape tension controls, door safety, spa pumps, boilers, garage doors, vacuum radon detection, pump control, pressurized air systems, sanitary systems, altitude sensing, fire protection systems.

G-force sensors and light switches containing mercury were formerly extensively used in vehicles in ABS systems, air bag sensors and auto seat belt mechanisms.

Flame sensors, also called automatic gas shut-off or safety valves, have been used as safety devices in gas and gas-electric ranges and other appliances.

Mercury arc rectifiers are used to convert alternating current into direct current. Mercury rectifiers were used in electric motor power supplies for industry, in electric railways, streetcars and diesel-electric locomotives. Small rectifiers were also used in different electronic equipment. The mercury content of rectifiers used for industry welding unit, old IT equipment and sound systems, and projectors is reported to be up to 1kg. The prevalence of these systems in Nigeria today is unknown.

Mercury in end-of-life and obsolete electrical and electronic equipment is of considerable concern in Nigeria because the quantities of such equipment imported into the country are increasing rapidly and have resulted in this becoming the fastest growing component of the solid waste stream. They are considered more fully under the section on Waste Management below.

Mercury-containing lamps

Lamps containing mercury and for both indoor and outdoor applications are commonly found in the country. Of types listed in Part I of Annex A of the Convention, Compact fluorescent lamps (fluorescent hot cathode), Linear fluorescent lamps, High intensity discharge (includes metal halide, ceramic metal halide, high pressure sodium, and mercury vapour), and Mercury short-arc lamps are all known to be in the market.

The inventory on mercury emissions and releases determined that a total of 51,189,155 lamps were shipped into the country between 2013 and 2014. Of these, 87% were from China while the remaining 13% were from 45 other countries.

According to the inventory report, 5,375,880 fluorescent tubes (double end), 40,692 High pressure mercury vapour, 54,576 UV light for tanning, 2,670,255 Metal halide lamps, 43,007,060 Compact fluorescent lamp (CFL single end) and 40,692 High-pressure sodium lamps respectively were imported 2013-2014. The mercury input for the inventory is estimated at 634 kgHg/y.

Cosmetics

Although mercury use in cosmetics is banned in Nigeria, there are fears that mercury added cosmetic products sold as creams, lotions and soap are still highly in use under cover. According to a UNEP survey, Nigeria has the highest users of skin lightening creams in all the countries studied as shown below:

Senegal, 27 %; Mali, 25 %; Togo, 59 %; South Africa, 35 %; Nigeria, 77 %; Hong Kong, 45 %; Republic of Korea, 28 %; Malaysia, 41 %; The Philippines, 50 %; and Taiwan, 37 % (Adabajo, 2002).

Creams and soaps containing mercury chemicals are imported illegally but it has not been possible to quantify the amounts. The prevalence of mercury in soaps and creams would need to be verified in future work.

Paints

It has not been possible to establish whether mercury containing paints are available on the Nigerian market. The amount is counted a zero.

Pesticides, biocides and topical antiseptics

Available Information is inadequate to calculate the quantity of biocides and pesticides produced and used in Nigeria.

Laboratory chemicals and equipment with mercury

These are imported into the country. The quantity imported has been estimated using the current population of Nigeria, 182,200,000, in combination with the electrification rate from the Toolkit (51 percent) acting as a development indicator. The mercury input estimated for the inventory is 1,822Kg Hg/y.

Non-electronic measuring devices

The use of mercury containing healthcare devices is prevalent in Nigeria. Mercury is contained in many common medical measuring devices such as sphygmomanometers (blood pressure devices), thermometers (specifically body temperature thermometers but also others) and a number of gastro-intestinal devices, such as cantor tubes and oesophageal dilators (bougie tubes). As in other types of instruments, mercury has traditionally been used in these devices because of its unique physical properties, including the ability to provide highly precise measurements, liquid at room temperature, large thermal expansion which is constant over a large temperature and high density.

Barometers are used for the measurement of atmospheric pressure in a number of professional applications including weather stations, meteorological departments, airports and airfields, wind tunnels, oil refineries, engine manufacturing, sporting sites, offshore installations (e.g. wind turbine parks) and on ships. A typical mercury-containing barometer consists of a one-metre glass tube filled with mercury. One end of the tube is sealed while the other end of the tube is expanded to form a bulb that is filled with mercury. A barometer for private households typically contains 60-75 g of mercury, whereas large barometers for laboratory use may contain up to 1.1 kg of mercury.

Mercury-free barometers are widely available and are marketed in the country, among these are: Electronic barometers (e.g. aneroid displacement transducers, digital piezo-resistive barometers or cylindrical resonator barometers); Electronic resistance or capacitance barometers; Aneroid mechanical barometers; Mercury-free liquid barometers.

Hygrometers (or Psychrometers) are used in the measurement of relative humidity. They consist of two (often mercury) thermometers mounted together, one of which is kept dry while the other is kept moist with distilled water on a cloth wick over its bulb and is called a wet-bulb thermometer. There are a number of mercury-free alternatives to mercury hygrometers. Spirit-filled hygrometers are available at approximately the same price as mercury hygrometers (Galligan et al. 2003). Electronic hygrometers are widely available and very much in use today.

Figure 5: A wet and dry bulb mercury hygrometer for indoor or outdoor use

Manometers measure the difference in gas pressure between the measured environment and a reference. The difference in the levels of mercury in each side of the tube indicates the pressure of the gas being measured. The filled volume varies, but it was estimated that each manometer contains 70-140 g mercury.

A number of mercury-free pressure-measuring instruments are marketed in Nigeria. These include

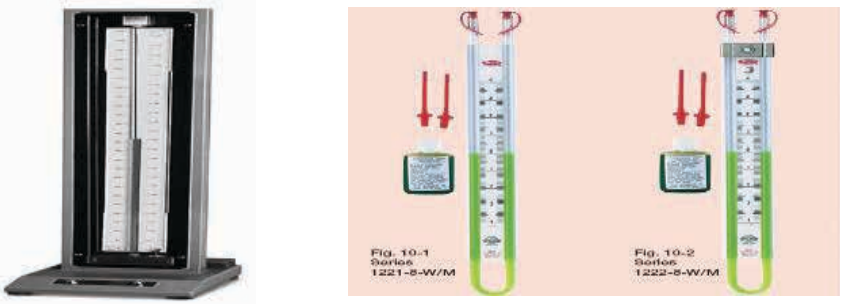


Figure 6: Examples of mercury containing Manometers

Bourdon tube manometers; Electronic (or digital) manometers; and Pressure gauges with diaphragm elements.

To estimate the quantity of mercury used in manometers and gauges in Nigeria, the current population of Nigeria (182,200,000) was used in combination with the electrification rate (51 percent) as a development indicator.

Mercury thermometers are used to read almost all temperature measurements from the freezing point of mercury, -39°C, up to about 800°C, with an accuracy of 0.01°C. For measurements at lower temperatures, down -58°C, hydrocarbons like toluene or pentane are used. For higher temperatures than 800°C, thermometers with a gallium filling are used.

In Nigeria, three types of mercury-containing thermometers have traditionally been imported into the market, these are:

i. Mercury-in-glass thermometers:
   a. Medical thermometers;
   b. Ambient temperature thermometers (wall thermometers);
   c. Laboratory thermometers;
   d. Thermometers for combustion and industrial processes.

ii. Mechanical mercury thermometers with a dial; and

iii. Contact thermometers (electric thermo-regulators)

The mercury content of medical thermometers ranges from 0.5 to 1.5 grams (Floyd et al. 2003). The mercury content of thermometers used in laboratories and in industry ranges from 1 to 20 g Hg per thermometer, with an average content of 3-4 g. Mercury dial thermometers, consists of a mercury filled metal tube with a bourdon coil and a pen or needle for reading the temperature, are used mostly in the power industry and for marine applications. Their mercury content ranges from about 5 to 200 g (Maag et al. 1996).

Mercury-containing thermometers are not produced in Nigeria but they are imported from other countries. Mercury-free thermometers of various types are also available in Nigeria as alternatives to the mercury-containing types. The inventory reported that a total of 6,647,750 thermometers of all types were sold in Nigeria in 2013. The data do not allow mercury-containing thermometers to be distinguished from mercury-free types. For this reason, it is assumed that all these thermometers contain mercury. The estimated mercury input was thus calculated as 20,093 kg Hg per year but this is likely to be an overestimate.

Sphygmomanometers (from Greek "sphygmos" for pulsation) measure blood pressure. Mercury sphygmomanometers comprise a mercury manometer, an upper arm cuff, a hand inflation bulb with a pressure control valve. It is used in conjunction with a stethoscope.

Mercury sphygmomanometers have been used for more than 100 years for blood pressure measurements in Nigeria and are still in use today by many clinics/ hospitals especially in the rural areas. Mercury sphygmomanometers manufactured in the EU typically contain 85 to 100 g mercury. Mercury-free sphygmomanometers, including digital varieties accredited by the WHO are available.

Mercury strain gauges are used for blood flow and blood pressure measurements in body parts. The mercury strain gauge consists of a fine rubber tube filled with mercury which is placed around the body part in which the blood pressure or blood flow is measured.

The annual consumption of sphygmomanometers is roughly estimated at about 150,000 items. The data do not allow mercury-containing devices to be distinguished from mercury-free types. For this reason, it is assumed that all these items contain mercury and this gives an estimated mercury input of about 12 t Hg/yr. This is a large number even for a big country like Nigeria, and is likely to be an overestimate.

Other medical equipment containing mercury has been identified. *Miller–Abbott tubes* are used to treat obstructions in the small intestine through intubation. It was developed in 1934 by William Osler Abbott and Thomas Grier Miller. The device is around 3 metres long and has a distal balloon at one end. It is made up of two tubes, one for inflating the ballon when in the duodenum and one for the passage of water. While inserted, barium can be passed through them, and this, alongside radiography, can provide diagnostic information regarding a lesion. A mercury-filled bag has been used with these tubes to assist with decompression of an obstructed intestine, although there are recorded cases of these rupturing and sometimes causing mercury poisoning. There is insufficient data to quantify the amount of mercury in use in these tubes in Nigeria.

Dental amalgam

Dental amalgam is a mixture of 50% silver alloy (silver 30% and 20% other metals: tin and copper and sometimes zinc, palladium or indium) and 50% mercury (Hardy and James, 1998; SDPI, 2013). It is widely used in Nigeria and is the preferred dental restorative material by dental practitioners because it is very strong, durable, cheap and easy to use. However, dental amalgam is gradually being replaced by composite resin, glass ionomer, porcelain, and gold, among other options and a rapid baseline assessment revealed that patient preference for dental amalgam fillings as considerably reduced (Federal Ministry of Health, 2016). This assessment estimated that the number of patients accepting amalgam restorations in Nigeria between January to December 2016 was 4,541,184 while the number of patients opting for alternative restorative dental materials was observed to have doubled to 315,360 people (Federal Ministry of Health, 2016).

Contributing factors to this change are thought to be

- a preference for tooth-coloured dental fillings,
- a significant reduction of training in the placement of dental amalgam restorations with a corresponding increase in training in the use of alternatives at a growing number of Nigerian dental schools.

Mercury may be released to the environment during preparation of the amalgam, during wear and tear of the amalgam in the mouth, and by disposal of waste water from dental clinics. It may also be released from the cremation and burial of dead bodies with amalgam fillings. Only about 46 percent of all the amalgam prepared for a restoration is incorporated into the new filling in the mouth, the remainder is discarded. The waste water systems of dental clinics may be fitted with traps to capture and retain amalgam but many clinics do not have such systems, do not have an environmentally sound means to dispose of the materials collected in the traps, or do not empty and replace the traps at sufficiently frequent intervals. Smaller amalgam particles collected in the vacuum equipment trap are disposed in the trash, or they pass through the trap and are released to the sewer system. Old fillings or teeth containing amalgam fillings that are removed at the dental clinics are typically disposed along general waste streams.

The current population of Nigeria was used as the number of inhabitants to calculate the quantity of the dental mercury amalgam fillings in combination with the WHO estimate for dental personnel density in Nigeria (minimum default of 0,02) and the estimated mercury input is 897 Kg Hg/y.

The use of dental amalgam is likely to remain an important restorative material for use in Nigeria for the foreseeable future. It follows that a plan compatible with Article 4 and Annex A Part II of the treaty will be required to reduce dental amalgam use and to avoid releases of dental amalgam from dental clinics. A progressive phase down of the use of dental amalgam in oral health care provision (WHO, 2011) will depend, in part, on trends in dental education towards increasing training in the use of alternative materials, growing public acceptance of alternative materials, and an increasing availability of cost-effective and more durable mercury-free restorative materials.

2.2.2 Artisanal and Small-scale Gold Mining

The use of mercury in artisanal and small-scale gold mining (ASGM) has been identified as the single largest intentional-use source of mercury pollution in the world (UNEP, 2002, 2013a). In most cases, nearly all of the mercury from the processing of gold ore is either emitted into the air or dumped into the surrounding environment and waterways, where it can be absorbed by living organisms. Mercury is intentionally added to the ore or gold concentrate to amalgamate with the gold particles making them easier to collect. The amalgam is then heated to drive off the mercury leaving the gold. The mercury volatilises into the atmosphere where it may be easily inhaled by those undertaking the process - often the miners and their families. This exposure to mercury can cause serious damage to the central nervous system, including respiratory failure, nausea, vomiting, diarrhoea, increases in blood pressure or heart rate, skin rashes, eye irritation, and kidney damage.

In addition to these health impacts, ASGM is associated with significant environmental degradation, including toxic pollution of air, land, and water; destruction of flora and fauna; landscape degradation and geological instability leading to landslides, flooding, and erosion; and radiation hazards. (Nyame, 2010; Heemskerk and Olivieira, 2003; Swain et al., 2007; Ingram et al., 2011; Eshun and Mireku-Gyimah, 2002; Keita, 2001).

ASGM activities come in different forms across the world but share many similar characteristics. Unlike large-scale gold mining, which is planned and centrally coordinated, ASGM is self-organizing and haphazardly carried out. While the former is driven by profit maximization, the latter is embarked upon to earn a living (Salati et al., 2014); hence, large-scale gold mining entities are easily distinguishable from ASGM. Studies by Salati et al., 2014; Ako et al., 2014; Azubuike 2011; Telmer 2011; Mireku-Gyimah, et al., 1996; Eshun and Mireku-Gyimah, 2002; Spiegel 2012; Cartier and Burge 2011; Elliot and Yohe, 1981; Hruschka 2012; Keita 2001; Bawa 2008; Amankwah and Anim-Sackey 2003; Okyere 2012; Telmer and Persaud 2013; UNEP, 2008; Hentschel et al., 2003; and Carstens et al., 2009, have identified the following characteristics of ASGM:

- Lack of management skills, and poor entrepreneurial attitude;
- Lack of understanding of deposits and resources, inability to select workable deposits, high mobility of miners;
- Lack of investment capital, low profitability, seasonal switching or alternation of gold mining with farming;
- low level of technology and improvised inefficient extraction methods;
- High labour intensity generating employment opportunities at community level;
- Informal/illegal status, lack of knowledge about legal requirements and limited access to mining titles;
- Traditional administrative authority and outlook;
- Inadequate or inappropriate regulatory regimes and a high tax burden on legalized ASGM operators;
- Widespread attachment to superstitious beliefs and fetish practices; and
- Negative environmental, health and safety impacts.

ASGM has long been practiced in Nigeria and demonstrates many of the characteristics set out above. Mercury amalgamation is widespread and, in addition, the high lead content of some gold deposits worked by ASGM has led to devastating health impacts. Bolstered by historically high gold prices, a lack of viable alternative livelihoods, and a ready and inexpensive supply of mercury, there has been a resurgence of ASGM activities in northern Nigeria in recent years. Unlike some African countries such as Ghana and Burkina Faso, Nigeria does not have a well-developed large-scale gold mining sector, and the majority of gold mining in the country is carried out by artisanal and small-scale miners.

Artisanal mining activities in Nigeria are almost by definition informal that is, operating outside current laws and regulations. While the current mining law and regulations do address artisanal and small-mining activities, mainly by focusing on the provision of extension services, they do not provide meaningful incentives and assistance for formalizing miners. For example, the requirement that artisanal miners form cooperatives in order to receive any technical assistance from the Ministry of Mines and Steel Development (MMSD) is a substantial obstacle for many miners, and means that most will continue to operate informally and without technical assistance. It also means that these miners are, in practice, unable to seek a small-scale mining licence, the only licence available to them under the mining law. Even where miners have formed cooperatives, it is not clear that they are receiving technical assistance from the Government.

Figures 7-8: Artisanal gold miners processing ore in Dareta, Zamfara state

The recent resurgence in ASGM in Nigeria has come at a considerable price namely: devastating lead poisoning of children and others from lead-contaminated gold ore; extensive mercury exposure, the effects of which have not yet fully materialized; and significant releases of mercury into the air and soil. In 2010, unregulated small-scale mining in Anka, in the northern state of Zamfara, gave rise to an epidemic of childhood lead poisoning, with at least 400 children under the age of five dying within a six-month period. The death-toll had risen to over 700 by 2013).

Despite the efforts of development, medical, and environmental experts both nationally and globally, lead contamination continues to afflict large numbers of children. The practice of mercury amalgamation at mining sites has also resulted in widespread mercury contamination of miners, nearby communities and the environment. Furthermore, despite a ban on mining activities imposed in all the affected villages, poor environmental management practices and a lack of responsibility for environmental remediation have left most of the abandoned pits unreclaimed. Some pits are several tens of meters deep and become flooded during the rainy season and thus represent a significant hazard for miners, other residents and animals. These have worsened the already escalated environmental, health and safety hazards in the area (Environmental Law Institute, 2014).

The legal framework governing mining activities and their environmental impacts are implemented primarily by two federal agencies –MMSD and FMEnv. The primary legal framework administered by MMSD consists of the 2007 Minerals and Mining Act and the 2011 Minerals and Mining Regulations. Three policy documents –the 2008 National Minerals and Metals Policy, the 2009 Vision 2020 National Technical Working Group on Minerals and Metals Development Report, and the 2012 Road Map for the Development of the Solid Minerals and Metals Sector–provide further guidance. These legal and policy tools address artisanal and small-scale mining to varying degrees. FMEnv administers the country's general environmental protection law - the National Environmental Standards and Regulation Enforcement Agency (NESREA) Act. The National Environmental (Mining and Processing of Coal, Ores and Industrial Minerals) Regulations 2009 also exist to minimize pollution from the mining and processing of coal and other minerals.

Gold production in 2013 is estimated to have been about 4 200 kg (United States Geological Survey, 2016) and it is inferred that this include ASGM gold production. The estimated mercury input for gold (and silver) extraction with mercury amalgamation processes is 21,000 kg Hg/yr.

Given the widespread use of mercury amalgamation, the disorganised and unskilled nature of ASGM activities, and the devastating health impacts of working lead-contaminated gold ores, Nigeria will need to consider whether ASGM is considered more than insignificant for the purposes of Article 7 of the convention. If so Nigeria, as a Party to the convention will be required to notify the Secretariat and to develop and implement a national action plan in accordance with Annex C to the convention.

2.2.3 Coal mining, Coal-fired Power Plants and Industrial Boilers

Globally, coal-fired power plants and coal-fired industrial boilers represent one of the largest cate-gories of point source emissions of mercury to the atmosphere. For this reason, these point sources are listed in Annex D and


Figures 9-10: ASGM activities in Nigeria

thus subject to the provisions of Article 8, Emissions, of the Convention. Mercury, a trace contaminant in the coal, is volatilised during combustion and emitted to the air. Some of the mercury may bind to dust or ash and may be captured by pollution abatement equip-2.2.3 Coal mining, Coal-fired power plants and industrial boilers

Globally, coal-fired power plants and coal-fired industrial boilers represent one of the largest categories of point source emissions of mercury to the atmosphere. For this reason, these point sources are listed in Annex D and thus subject to the provisions of Article 8, Emissions, of the Convention. Mercury, a trace contaminant in the coal, is volatilised during combustion and emitted to the air. Some of the mercury may bind to dust or ash and may be captured by pollution abatement equipment, thereby entering solid waste streams. As such coal-fired power plants and boilers also represent relevant point sources of releases of mercury to land and water.

Nigeria holds large resources, estimated to be in excess of two billion metric tonnes, of predominantly sub-bituminous coal. Coal has been mined for more than 100 years and was previously used for electricity generation. The low sulphur, moderate ash character of the coals also made it attractive to certain export markets. In recent years, production has declined and coal does not figure as a fuel used in energy generation.

Table 10 shows historic coal production levels and implies that there has been no significant production of coal in Nigeria since 2002. However, efforts to revitalise coal mining are underway and a total of 989,155 t was produced in 2016 (National Bureau of Statistics, 2017). Coal consumption is considerably in excess of this figure. The MIA inventory exercise conducting in 2017 revealed that 2,021,760 t of bituminous hard coal was burnt, implying that the bulk of coal being used is imported. Some industries, such as cement manufacture, have started using coal as an energy source to overcome continuing shortages and disruptions in the supply of gas and oil. Coal is also used locally as a domestic fuel source, for brick manufacture and in industrial boilers. At present, coal is not being used for the generation of electricity but several coal-fired power plants are under construction or planned.

TABLE **10**

Coal Production Levels in Nigeria

YEAR	PRODUCTION (Tonnes)
1924	220,161
1928	305,745
1932	256,860
1936	310,308
1940	318,640
1944	669,158
1948	610,283
1952	613,374
1956	790,030
1960	565,681
1964	698,502
1972	264,258
1976	249,446
1980	114,875
1984	139,744
1987	117,159
1992	27,686
1996	17,797
2002	41,771
2003	N/A
2011	N/A

Source: (Odesola et.al; 2013)

The revitalization of the coal-mining industry and the construction of coal-fired power plants form key parts of the National Energy Policy, 2003, which sets out Nigeria's plans to expand power generation to ameliorate the power sector's long history of under-investment in generation, transmission and distribution. Currently, only about 40% of the population is connected to the national grid. The distribution network is concentrated predominantly in urban areas with only 20% of rural households connected to the grid. The increased use of coal for power generation would serve to augment energy supply and diversify the fuel mix in order to overcome difficulties experienced with other fuels. Several coal-fired power plants are now under construction or planned. A 1,200 MW coal-fired power station is under construction at Kogi (Itobe), and two others, with capacities of 1,000 MW, are planned for Enugu and Gombe states.

The major expansion of coal-fired energy generation planned in Nigeria will need to be considered in plans to meet Nigeria's obligations under the Minamata Convention. As a future Party to the Convention, Nigeria will need to consider compatible with Article 8 of the convention to control emissions.

Coal deposits are located as follows:

The **Anambra Coal Basin**, located in south-eastern Nigeria, appears to contain the largest and most economically viable coal resources. This basin covers an area of approximately 1.5 million hectares and is constrained by the Niger River on the west, the Benue River on the north and the Enugu Escarpment on the east. The coal is predominantly in one seam that crops out along the eastern side of the basin at the base of the Enugu Escarpment and dips gently toward the centre of the basin. However, coal outcrops have been reported at Idah and Dekina on the northwestern side of the basin, demonstrating that coal exists on the western side of the basin as well as the east. Exploration within the basin is limited, but there are four small coal mines in the eastern outcrops of the basin northwest of the city of Enugu and two smaller mines farther north.

The **Kogi Coal District**, covering 225,000 hectares of the Anambra Coal Basin, lies on the northeastern side of the basin. Two areas within the district have been explored to a limited degree:

- at **Ogboyoga**, Behre Dolbear used the guidelines of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (also known as the JORC Code) to delineate a total of 123 million metric tonnes of coal (demonstrated) underlying an estimated 8,900 hectares and an additional 165 million tonnes of coal classed as non-reportable resource by the JORC Code definitions. The coal thickness in this area is approximately 2.0 meters.
- at **Okaba**, the site of a small abandoned mine. A total of 100 million tonnes of demonstrated coal (JORC) have been estimated from drill information. An additional 435 million tonnes of non-reportable coal resource are projected to the west of existing drilling.

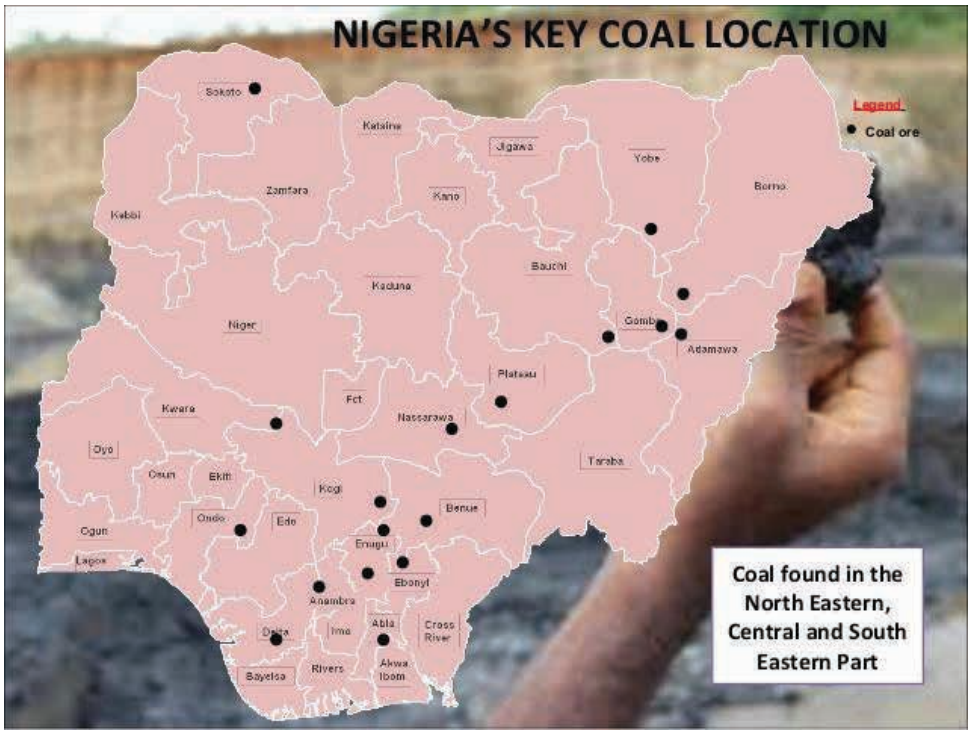
The **Benue Coal District**, covering 175,000 hectares of the coal basin, is immediately south of the Kogi District along the eastern outcrop of the Anambra Basin. It has two areas of interest:

- **Orukpa**, where outcrop and drill information allowed Behre Dolbear to estimate demonstrated coal resources of 81 million tonnes with a further 117 million tonnes of non-reportable coal (JORC) projected to exist west of the demonstrated deposit. The average coal thickness is 3.1meters.
- **Ezimo**, immediately south of the Orukpa area, has been subject to only limited exploration. Based upon the limited data available, a total of 43 million tonnes of demonstrated coal resource have been projected. An additional 263 million tonnes of non-reportable coal resource is considered to exist west of the existing drilling. The average coal thickness in this area is also 3.1 meters.

The **Enugu Coal District**, covering 270,000 hectares of the coal basin, is centred around Enugu City, south of the Benue District. It has supported the largest amount of commercial mining in the past. In addition to two underground mines, there are a total of 36 drill holes drilled in the area. Previous studies have estimated the demonstrated coal resource to be 49 million tones averaging 2.2 meters thick. An additional 111 million non-reportable tonnes of in-place coal are inferred to exist west of the old mine workings.

Other potentially significant coal and lignite resources in Nigeria include:

- The **Inyi** deposit south of the city of Enugu with a potential resource of approximately 10 million tonnes;
- The **Afikpo** deposit located south and east of Inyi in an area that is heavily populated, where mine development might be expensive;
- The **Lafia Obi** deposit located northeast of the mining districts described above with an estimated inferred



resource of 33 million tonnes of potential metallurgical-grade coal resources.

- The **Gombe** deposit is located east of Lafia-Obi. Preliminary drilling has indicated the presence of metallurgical grade coal, but no resource estimates have been made for this area;
- The **Asaba** lignite deposit is on the coastal plain south of the Anambra Basin. A total of 19 holes have been drilled in two areas. Although these data are limited they strongly suggest that a significant lignite resource exists in this area. More exploration is required to determine if it is an economic resource.

2.2.4 Smelting and Roasting Processes in Non-ferrous Metal Production

The smelting and roasting processes used in the production of non-ferrous metals, in particular copper, lead, industrial gold and zinc, may be significant point sources of mercury emissions. Mercury may occur, in particular as mercury sulphide, cinnabar, with the sulphide ores of these minerals and so be liberated during their processing.

Lead and Zinc deposits are known mainly in the northern and eastern parts of Nigeria. They have been mined in Nassarawa State, at Akwanga, Nassarawa Eggon and Wamba; at Jos in Plateau State; in Bauchi State, Alkaliri Local Government area; and at Filia in Gombe State, Taraba, Kaduna and Kogi.

Production of lead/zinc ore is declining. While 800,000 t of ore was produced in 2011, production had fallen to 400,000 t by 2013 (United States Geological Survey, 2016a). No large-scale smelter production is reported for either mineral (United States Geological Survey, 2016b; United States Geological Survey, 2016c).

Further investigations will be required to assess possible small-scale production of lead and zinc and to ascertain whether that production is being smelted locally.

Copper is produced in Nigeria but quantities appear to be very small, insufficient for a commercial smelter operation. Further investigations will be required to assess possible small-scale production of copper and to ascertain whether that production is subject to small-scale smelting locally.

Gold is found in North West, North Central and South West Nigeria. Gold deposits found in Northern Nigeria are most prominently in the schist belt in Maru, Anka, Malele, Tsohon Birnin Gwari-Kwaga, Gurmana, Yauri, Dogondaji, and Iperindo in Osun state. At Segilola, in

Osun state, indicated resources in excess of 50,000 ounces of high grade gold have been outlined and further exploration is in progress (Thor Explorations Ltd, 2017). There are also a number of smaller occurrences beyond these major areas. Over 30 licences have been issued to co-operative societies and companies for mining of gold in the country. Most of the concessions are still at the exploration stage. (NEITI, Solid Minerals Sector Audit report for the year ended 31 December 2014).

Gold production in Nigeria is estimated at 4,200 kg in 2013 (United States Geological Survey, 2016a) but this may include ASGM gold production. The estimated mercury input for Gold (and silver) extraction with mercury amalgamation processes is 21,000kgHg/yr.

Mercury is not produced by primary mining in Nigeria .

Aluminium is produced in Nigeria. The Aluminium Smelter Company of Nigeria operates a smelter plant in Akwa-Ibom State with the capacity to produce 110,500 t/yr. of aluminium from local bauxite. It is the largest aluminium smelter in Sub-Sahara Africa.

Management and production difficulties mean that the plant is operating significantly below capacity. 26,000 tonnes of primary aluminium was produced in 2012 but production in later years seems to have been much less (United States Geological Survey, 2016a). The estimated mercury input is 55 kg Hg/yr.

Bauxite may contain trace quantities of mercury, which can give rise to emissions of mercury vapour, especially in the upstream part of the refining process. Pollution abatement technologies must be in place to capture mercury emissions and releases. Some facilities use condensers to remove mercury from vapour.

Pollution abatement facilities at the Akwa-Ibom smelter have not been documented. There may be a need to assess the facility and to make recommendations with regard to mercury emissions abatement and to train personnel in its operation and the environmental sound disposal of any mercury that may be collected.

Iron Ore is produced at a small scale in Nigeria and may be subject to small-scale smelting. Annual production in 2016 is estimated at 1548 t (National Bureau of Statistics, 2017)

2.2.5 Cement Sector

Cement can be defined as a hydraulic binder, which hardens when water is added. It is seldom used alone and is typically added to fine aggregate to produce mortar for masonry, or is mixed with sand and cement aggregates to produce concrete. As such, it is an important material in many forms of construction work.

Mercury may be released during the production of cement where it is present as a trace contaminant in either the raw materials, particularly the limestone, or the fuels used. Concentrations of mercury in these raw materials may vary widely both between deposits and within an individual deposit. The fate of mercury generated during production will depend on production processes. In many cases it may be volatilised in the kiln and bind to dust particles circulating between the kiln/ preheater raw mill and dust precipitator.

In Nigeria, cement is used in the construction of residential and public buildings, roads, bridges and drainage as well as in the rehabilitation of infrastructure. It is therefore an essential commodity which forms part of day-to-day life for the average Nigerian. Rising investment in infrastructure in Nigeria has led to an increase in demand for cement since 2013. Statistics have shown that Nigeria has the largest demand for cement in sub-Saharan Africa and about 95 per cent of the inputs for cement production are sourced locally.

The basic inputs into cement manufacture are Limestone, Red alluvium, Shale and Gypsum. With the exception of gypsum, which occurs in Nigeria only in thin vein layers, Nigeria is abundantly endowed with all the other inputs. Limestone, the major input occurs in all the six geopolitical zones of the country. Apart from these basic raw material inputs, the other major requirement for cement production is fuel. Nigeria, as a nation, is rich in all sources of energy: (crude) oil, gas, coal and other alternative fuel (waste) but experiences supply difficulties.

Given its importance to national development, the cement industry was one of the earliest import-substitution industries in the country. The history of cement production in Nigeria dates back to 1957. There are now six manufacturers of cement in the industry and the volume of local production had increased dramatically from 2.5 million tonnes in 2004 to 10.5 million tonnes by 2010. According to

the industry, total cement production capacity for the country is now about 38 million metric tonnes per year but actual production is less than this and some cement is imported to meet Nigeria's cement consumption rate of about 22-25 million tonnes. Table 11 provides an overview and assessment of the cement industry in Nigeria carried out be the Federal Ministry of Trade and Industry in 2016. However 38 million t/y cement is used in the calculations as a conservative estimate, resulting in an estimated mercury input of about 4180 t Hg/y.

TABLE **11**

Summary of the Report on the Evaluation and Assessment Exercise of the Cement Industry in Nigeria

S/NO	Name of Company	Installed Capacity (MMTPA)	Capacity utilization			Projected Production (MMT)		Staff strength	Challenges	Remarks
			2014	2015	Jan-July 2016	2016	2017			
1	Dangote Cement Obajana Kogi State	13.25	12,985.00	11,528. 00	9,675.00	10.00	11.00	2,203	• Bottleneck in export • Low supply of LPFO • High cost of enery	Commissioned additional 3mmtpa line 4 project
2	Dangote Cement Gboko, Benue State	4.00						590	• Hostility from the host community • High forex and multiple taxation	Planning to set up additional 3mmtpa.
3	Dangote Cement Ibeshe, Ogun state	12.0	6960,000	5,040,000	5,056,000	7.900,000	8,000,000	1700	• Low gas supply • Insecurity • Bad roads • Non daily boarder patrol this reduce export volume	Production of the plant reduced because of non availability of gas supply due to vandalization by militants
4	Lafarge Africa Plc, Ewekoro, Ogun State	2.2	1,819,400	1,688,940	1,677,060	2,100,000		188	• High duty on machinery • Accessing forex • New products certification	Depend on coal to fire its kiln and has the ability to use biomass
5	Lafarge Africa Plc, Shagamu, Ogun state	1.0	747,402	733,689	272,684	750,000		179	• Policy inconsistency • Scarcity of forex	Also produce oil well and surface resistance cement
6	Lafarge Holcim Mfamosing, Calabar, Cross River state	2.50	2,000,000	1,875,000	1,000,000	2.3	4.1		• Gas and AGO scarcity • Insecurity in the land • Scarce forex • Multiple taxation	2.5 mmtpa, additional line project 90% completed
7	Ashaka Cement Plc, Ashaka, Gombe state									

S/NO	Name of Company	Installed Capacity (MMTPA)	Capacity utilization			Projected Production (MMT)		Staff strength	Challenges	Remarks
			2014	2015	Jan-July 2016	2016	2017			
8	Cement company of Northern Nigeria (CCNN), Sokoto	0.5	471,0000	400,000	246,771	486,084	1000,000	337 plus 687 indirect	• Export bottleneck • High energy cost and scarcity of LPFO from local refineries • Accessing forex	The installed capacity of the plant will increase to 1.7mmtpa with commissioning of its 1.2mmtpa line project in 2017
9	BUA cement Obu Okpila, Edo state	3.0	Nil	Nil	1100,000	Nil	Nil	388	• Lack of rail and poor roads • Scarcity and high cost of LPFO • Lack of forex • Insecurity and multiple taxation	The installed capacity will double upon completion of the 6 mmtpa additional line in the 2nd quota of 2017
10	Purechem industries Ltd, Onigbedu, Ogun state	0.96	87,760	87,663	49,370	900,000		285 and 49 indirect	• High duty on pet coke • Levy on raw materials, finished products and imported raw materials • Interrupted gas supply	The only mini cement plantin Nigeria and the plant utilizes most of its cement produced in house
11	Ibeto Cement Plc	Nil	Nil	Nil	Nil	Nil	Nil		Bought over Nigercem Nkalagu in 2012 but could not accessthe plant due to the lingering problem with the Ebonyi state government until recently, hence the company signed (MoU) with its Chinese partner for setting up 6000mtpd cement plant.	
12	White Cement Ugumale, Benue State	150 mtpa white cement and 450mtpa Portland	Not yet in operation	Nil	Nil	Nil	Nil		• High duty on machineries	The plant is about 80% completed, jointly owned by Chinese company and Benue State Government
13	Reagan Cement Plc, EPZ, Calabar Cross River State	Packaging plant	Nil	Nil	Nil	Nil	Nil		Recall of loan for setting up of 2.2mmtpa integrated cement plant by Bank of Industry (BoI)	Soliciting for the Ministry,s intervention to enable it forge ahead.

Source: FMITI, 2016

No information has been gathered during this assessment on either the actual mercury content of the raw materials used in cement production in Nigeria or the mercury content of emissions and releases from cement plants. It follows that further investigations are required to verify inventory results based on production activity. Given the highly variable nature of mercury content in the raw materials used in cement production, a programme of testing of these materials is likely to be required. The results of such a programme would confirm the need for action in the cement industry in accordance with Article 8 of the Convention or, potentially, eliminate this sector as a significant source of emissions and releases in Nigeria. Where action is found to be required, efforts to reduce mercury emissions could take advantage of continuing investment by the cement companies in new plant and facilities. In this regard, there may be a parallel need to consider and establish national guidelines on mercury abatement taking in account technologies and techniques considered to represent BAT/BEP.

Further details of the major cement industries in Nigeria are given below:

The Dangote Cement Group has a local market share of about 60 per cent while other manufacturers and importers share the remaining 40 per cent. Manufacturers with smaller market shares may have significant regional presence. For example, Lafarge WAPCO dominates the south-west markets while Ashaka cement dominates sales in the north-eastern region of the country. The UniCem cement company and the Cement Company of Northern Nigeria (CCNN) are strategically positioned to serve the south-eastern and the north-western markets respectively.

This widespread location of cement production and the fragmentation of cement market in the country reflects, in part, the need to base production on suitable deposits of limestone, and the high transport costs of other raw materials and of the finished product.

Dangote Cement Plc comprises cement plants at Obajana, Ibese, and Benue Cement Plant, Lagos Cement Terminal and the Dangote Onne Terminal. The company is a fully integrated quarry-to-depot producer with current production capacity of 32 million metric tonnes per annum.

A field visit was made to the Obajana cement plant.

The plant is located about 1 km from the residential area of Obajana, in Kabba/Bunu Local Government Area of Kogi State on a land originally belonging to Oyo-Iwa community. It is about 200 kilometers from Abuja. Obajana was previously a predominantly agrarian community whose chief crops are cassava, maize and yam but, as a result of the establishment of the plant, Obajana is now one of the fastest growing rural communities in Nigeria The population has grown because of the facility's potential to generate 30,000 additional jobs.

The cement plant is the largest in Sub-Saharan Africa with a production capacity of 10.25 million metric tonnes per annum across three lines and a further 3 million metric tonnes per annum capacity currently being built. The annual production of the plant is stated as 7,535,533; 7,481,997; 8,022,378 tonnes per annum for 2013, 2014 and 2015 respectively.

The plant has four (4) automated processing lines which are interconnected and the processes involve crushing and mixing with additives to produce clinker and subsequently cement. The pollution control equipment used in the plant includes electrostatic precipitators (ESPs) and bagfilters located at points of agitators. The plant has over 230 bag filters and about 4 ESPs.

The plant uses natural gas and Low Pour Fuel Oil (LPFO) as fuel but supplies of these are insufficient and the company imports and uses coal as a substitute fuel. Currently, the company is making arrangement to start mining coal in-country, since Nigeria has abundant coal deposits. Presently, 75 tonnes of coal per hour is used in the plant.

LAFARGE Ashaka Cement Plc is a cement manufacturing company and a subsidiary of Lafarge Group. Ashaka became part of the Lafarge group in July 2001 and since that time Lafarge has continued to support Ashaka's operations to improve its performance in Nigeria.

Figure 11: Design of Obajana Cement Plant showing proximity of the facility to a water body in the community

Figure 12: Aerial view of Obajana facility showing proximity to the community

Figure 13 Cement facility close to farmlands

A field visit was made to Ashaka Cement:

Ashaka Cement Plc is located close to Bajoga town which is headquarters of Funakaye Local Government; the population of the area is about 236,000.The means of livelihood of the inhabitants are mainly farming, cattle rearing and fishing.

The plant has 422 permanent staff and 350 temporary and contract staff and produces only cement. According to the industry, as at 2015 the company's average production rate was 700,000 t per year.

The manufacturing process involves quarrying and transporting the limestone raw material to the crusher at which point the limestone is reduced to pass 30mm. The dust collector equipment (DCE) attached to the crusher absorbs the smaller particles (the mesh size not known). The capacity of the crusher is 500 tonnes per hour for 12-16hours per day.The crushed limestone is then transferred to the kiln by means of conveyor belts and the additives (Iron Ore and River sand) are introduced. The kiln system is heated to a temperature of 1400 -1450 degrees centigrade to produce clinker. The clinker is then transferred to the cement mill where gypsum is added to produce cement.

Coal and LPFO are used as fuel for the heating process. Coal consumption is estimated at 8-9 tonnes per hour. The coal is sourced from local miners located at Maiganga coal mine site in Akko Local Government Area of Gombe state.

Pollution control equipment used in at the plant comprises bag filters, ESP and dust filters

Also attached to the cement mill system is the gas analysizer to confirm the trace elements emitted.The company also has a quality assurance room, control room and X-ray room.

The company considers its major challenge to be the high cost of production arising from the inadequate source of fuel to power the kiln and the old production technologies employed.

LAFARGE Atlas Cement Company Limited was incorporated in 1999 and is a 100% owned subsidiary of Lafarge Africa Plc. The Company's terminal was commissioned for operation in 2001 in Rivers State within the Federal Ocean Terminal, Onne and the plant was operated on a floating vessel which had a nominal capacity to produce 500,000 metric tons of cement per annum.

United Cement Company of Nigeria Limited (UniCem) is a joint venture between Lafarge Africa Plc and Holcim commissioned in 2009. The company

Figure 14: A section of the Ashaka cement production line hereabouts

has a production capacity of 2.5 million metric tonnes per annum and is one of Nigeria's largest cement manufacturers with strong presence in the South-East and South-South regions. To meet the increasing demand for its products, an additional manufacturing line with a production capacity of 2.5 million metric tons is currently being constructed within the existing plant.

West African Portland Cement Plc (WAPCO) was established in 1960 with a factory in Ewekoro, Ogun state. The company commenced production with an initial capacity of 200,000 tonnes per annum but later increased this to 1.5 million metric tonnes per annum. However, in the late 1990s, the company began to suffer reduced output as a result of the obsolete technology and outdated production process. In August 2003, it commissioned a new ultra-modern plant in Ewekoro. The plant has a capacity of 1.3 million metric tonnes per annum and has continued to produce at optimal levels since then.

Cement Company of Northern Nigeria Plc (CCNN) was incorporated in 1962 and began production in 1967 with an initial installed capacity of 100,000 metric tonnes per annum, using the wet process of production. The need to meet the increasing demand for cement necessitated the expansion of the plant with the commissioning of a second line with an installed capacity of 500,000 tonnes per annum in 1985. The company is currently being managed by Scancem International of Norway, a member of Heidelberg Cement group

2.2.6 Industrial Fugitive Emissions

The **pulp and paper industry** converts wood or recycled fibre into pulp and primary forms of paper. Mercury is potentially released at paper mills as an incidental emission or release during production; for example from trace content in the wood or other raw materials or from the combustion of fuel to generate power for production. It may also be used in equipment and instrumentation at the production facility.

Three paper mills were established by the Federal Government in the 1960s and 1970s but struggled to source sufficient long-fibre wood resources to support production. As a result, the two remaining plants have switched production to the use of recycled paper. Production of paper from recycled fibre is however not considered a significant mercury source, as the only mercury input that is released is from any use of fuels in the production.

Further details of the paper mills, based on information gathered during field visits, is given below.

The **Jebba Paper Mill** was established in 1970 to produce pulp from wood sourced from its 3,000 hectares of gmelina plantation. However the mill has been converted to produce paper by recycling scrap papers rather than using virgin pulp. It is the only fully-functional integrated paper mill producing brown Kraft paper by recycling waste scrap papers in West Africa.

The mill is located at Jebba in Kwara State, a community of about 35,000 whose major occupations are farming and fishing.The paper mill has 400 staff working in the mill and, in addition has created over 2000 indirect employment opportunities all over the country in sourcing scrap paper. The mill is designed to run continuously but experiences difficulties in energy supply; 350 units of power is needed to produce 1 t of paper. The boilers produces 12 t of steam per hour. Power is generated using LPFO as fuel to boilers but during shortages of LPFO the plant uses DOC, consuming up to 60 t of DOC.. The company plans to diversify energy supply further by using coal. Scrubbers or ESPs are not installed in the company's paper production. However ESPs were installed in part of the mill that was previously used to produce pulp from wood before the mill was privatized.

Production is increasing and in 2015 the company produced 42,000 t of paper from 46,000 t of waste paper. The mill also has plans to diversify production by introducing a compactor in the plant to produce plastics.

The **Dahua Paper Mill**, the largest paper mill in Africa, produces kraft paper from recycled papers and board at Abeokuta, Ogun State. It has recently begun production and has a planned production capacity of 300,000 t per year. In order to maintain a sufficient supply of waste paper for recycling in the plant, the company has established collection centres in 18 states making it the largest recycler of paper in the country.

The sludge arising from the treatment of waste and recycling at this company are sometimes emptied into the nearby stream untreated.

Figure 15: Used paper raw materials for paper production at the Jebba paper mill

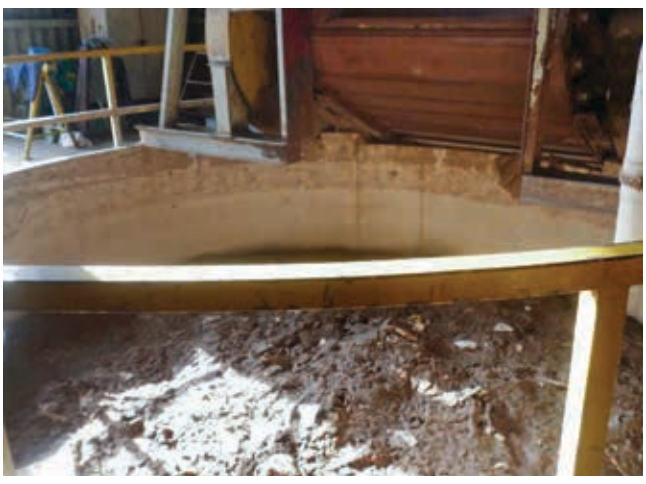


Figure 16 and Figure 17: Processed raw materials at the Jebba paper mill

2.2.7 Waste Management

Waste management is the activity of collecting, transporting, processing, recycling or disposal of waste materials generated by human activities. Waste management is carried out so as to reduce the effect of waste on human health, environment, and aesthetics and to recover valuable resources that might otherwise be lost (Afun S, 2009). It is a global issue that is a growing source of concern in developed and developing countries as a result of increased urbanization; changes in consumer patterns and industrialization, all of which directly influence waste generation. Waste management services in developing countries are typically confined to urban areas and even here, local authorities are experiencing difficulties in expanding services to new residential areas, particularly where these are informal and unplanned. Furthermore, disposal opportunities may be limited and not keeping pace with the increasing volumes of waste being generated. As a result, mixed municipal solid wastes that have received little or no treatment are disposed to landfills that themselves have had only the minimum of preparation.

Municipal solid waste is the combination of a city's solid and sometimes semi-solid waste. It may be classified by the source from which is has arisen or by its composition.

- Three principal sources from which municipal solid waste arises are:
- residential or domestic waste consists of household garbage and rubbish, or refuse;
- commercial waste is that arising from markets, shops and offices and typically includes biodegradable materials, paper and plastic packaging;
- industrial waste that arises from industries and could include a wide range of materials such as metal and wood, glass, packaging, containers with waste oils and fats and so on.

It includes mainly households or domestic waste, but it can also contain commercial and industrial waste although hazardous waste from industry is usually considered separately (Gordon, 2005).. It can be categorized compositionally into:

- *biodegradable waste:* including food, and kitchen waste such as meat trimmings or vegetable peelings, yard or green waste and paper;
- *recyclable materials*: including non-biodegradable items like glass, paper, metals and plastics;
- *inert waste*: such as construction and demolition waste, dust and ashes;
- *composite waste*: typically discarded products comprising more than one material such as clothing, household goods and toys.
- *household hazardous waste* including medicines, paints, batteries, light bulbs, fertilizers and pesticides containers and electronic waste (e-waste) like computers, printers and cellular phones.

Typically, municipal solid waste is made up of a complex mixture of these substances, it includes materials with residual value that is, or should be, of interest for example in composting and recycling. It also includes ever-increasing amounts of potentially hazardous materials such as heavy metals, including mercury, from, for example, batteries, fluorescent tubes, discarded electrical and electronic equipment; and a range of toxic chemicals that occur in discarded medicines, agro-chemicals, solvents, paints and preservatives, disinfectants and cleaning products.

The composition, volume, and weight of municipal solid waste will vary from place to place depending on such factors as the culture and ways of life of the people, the economic activity in the area, and the population size of the urban centre.

Municipal waste collection services in Nigeria are largely confined to the urban centres. They are offered by State Governments principally as public sector services with some level of formal public-private participation (PPP). They are, however, considered inefficient with few schemes collecting more than 5% of the waste generated and it is not uncommon to see informal waste collectors using local vehicles (push carts) for collection services from door to door in some parts of Nigerian cities.Waste management schemes in Lagos and Calabar (in Cross Rivers State) are considered exceptions. The relatively success story of Lagos could be traced to the level of cost recovery from the public (waste generators) and strong political will towards good waste management in the State.

The Lagos State Waste Management Authority (LAWMA) provides 240-litre bins for households after annual payment of the Land Use charge through the Land Records Company. LAWMA engages, coordinates and evaluates the collection activities of its more than 300 private sector participants. Collection frequency is either once or twice a week and usually on a door-to-

door basis. However, it is not uncommon that collection frequency falls below this standard, particularly in densely populated areas.

Typically, over 50% of municipal solid waste in Nigeria is biodegradable waste. The composition of the remainder varies considerable from area to area.

In rural areas, and in urban areas where solid wastes are not collected, wastes are dumped unmanaged and uncontrolled on any available land. Wastes dumped this way are typically burned periodically principally to reduce their volume. Such open-burning of wastes is a major concern as materials burned includes polythene, tyres, and substances that produce dangerous gases to the environment (Butu and Mshelia, 2014). Beukering et al, (1999), in analyzing urban solid waste in developing countries (including Nigeria), concluded that a large quantity of the waste is dumped in an uncontrolled manner, or, worse, burned in the open air. These practices obviously form the lowest level of the waste management hierarchy.

Recycling activities, the greatest impact of which is to reduce the net volume of municipal solid waste that must be disposed, have traditionally been the practice of the informal sector and concentrated on materials of particular value. Itinerant waste buyers, or scavengers, target materials such as plastics, paper, used electronic electrical equipment, glass, and metal. As the market for certain commodities grows and as technologies and techniques for recycling become more readily available, there is increasing interest in recycling from the formal sector.

Some States have established, or are planning to establish, pilot projects to determine the best approaches to the separation at source of waste and the recycling of particular waste streams. Examples of recycling activities in Lagos State include:

- *Composting* at Ikorodu for the treatment of market waste generated between 24,000 t and 42,000.00 t of compost in 2nd half of 2011;
- *Waste-To-Energy* plant at Ikosi Market generates biogas from the market waste. The gas generated is used to operate 2KVA generator at the market;
- *Plastic recycling* at Olushosun converts water sachets into garbage bags as part of a government buy-back programme for water sachets, cartons, paper and glass.;
- *Recycling banks*, introduced in some areas to encourage households to deposit their recyclables like plastics, cans, bottles;

The recycling of waste paper and board is significant, generating the feedstock for two paper mills described above. Paper collection centres have been established to facilitate the collection of waste paper from informal recyclers and so ensure a steady flow of raw materials to the paper mills.

Despite the importance of informal recyclers, there is no formal integration of recyclers into the system except in Lagos State where waste scavengers are employed by the LAWMA to manage recycling banks. As managers, they receive an income from the Authority as well as the recyclable materials to trade. The scheme seeks to encourage them to promote waste separation and recycling at the banks and to dissuade them from working on unseparated wastes at the main dumpsites. However, the numbers of the recycling banks is not sufficient to cater for the numbers of scavengers in the cities hence some of them are still allowed to scavenge materials at the site but are encouraged to use protective equipment.

Figure 18: Scavengers wait for the offloading of mixed municipal waste at the Gosa dumpsite, Abuja

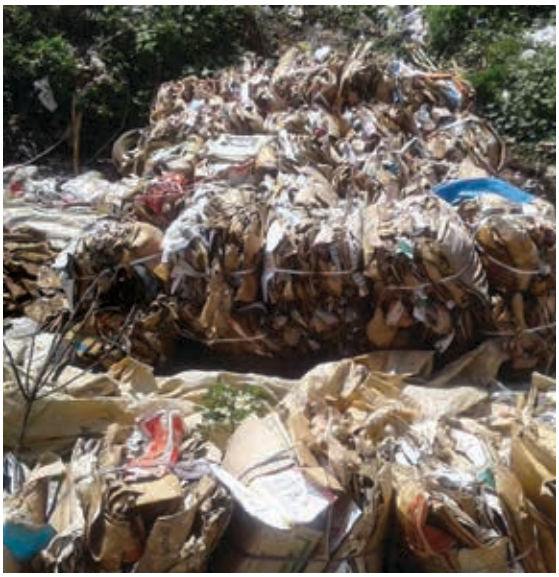


Figure 19: Paper waste recovered by scavengers for recycling

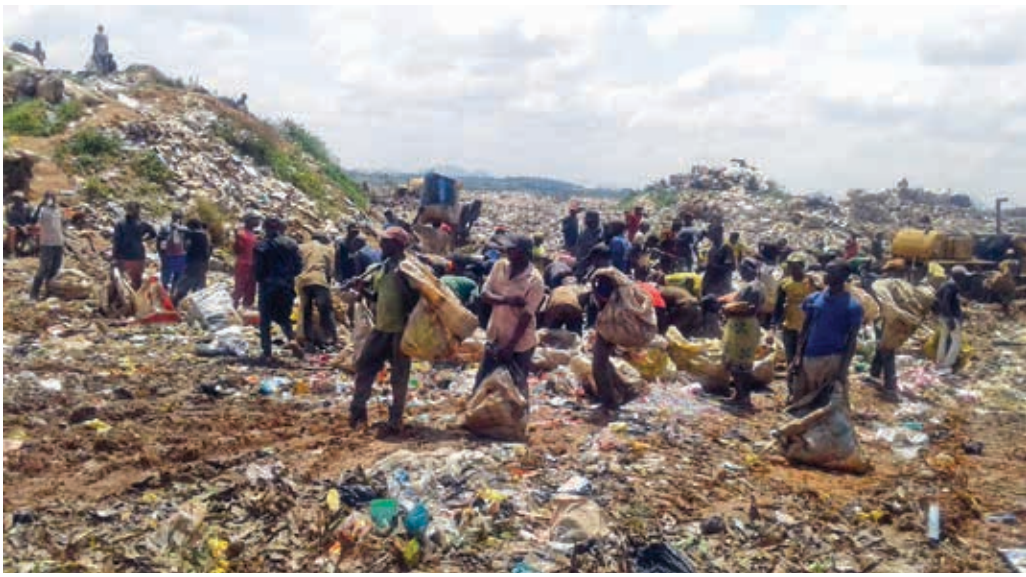


Figure 20: Scavengers picking through recently dumped waste at the Gosa dumpsite, Abuja

Recycling of vehicles is carried out and an estimated 19,277 vehicles are recycled per year in Nigeria. Some of the older vehicles that are recycled may contain mercury switches and lights and for this reason the recycling activity may lead to mercury releases. Based on the Toolkit's default input factor of 1.1 g Hg per vehicle, a rough estimate of mercury contents in these older vehicles is 21 kg Hg/y. This may be an overestimation, as mercury-switches in cars have been phased down for many years now.

The **disposal** of wastes collected through municipal services takes place at dumpsites designated by the authorities.

The Olusohun dumpsite serving Lagos, is possibly the largest in Nigeria and is one of 5 approved dumpsites in the State. The Lagos State Government is working on extracting methane gas from the site as well as from another dumpsite at Abule Egba.

In Abuja, the Gosa waste dumpsite serves as the central refuse dump for all the household and industrial waste in the Federal Capital city and is, undoubtedly, the biggest in the city. It covers 90 hectares of land and is under the management of Abuja Environmental Protection Board (AEPB). Efforts to upgrade the dumpsite are currently underway.

The quantities of municipal solid domestic solid waste generated in Nigeria are not known in detail. At present, LAWMA estimates the rate of municipal solid waste generated in Lagos, with an estimated population of over 21 million in 2017, at 10,000 t per day. In Kano State, the Kano State Refuse Management and Sanitation Board (REMASAB) estimates that 4,000 t per day of municipal solid waste is generated.

Across Nigeria, the average rate of municipal solid waste generation is estimated as 0.5 kg per person per day, that is, about 90,000 t per day or about 33 Mt/yr.

Of this quantity, informal dumping is estimated at about 13.6 Mt/yr (Hg content ~13.6 t/yr), open burning accounts for an estimated 10.9 Mt/yr (Hg content ~10.9 t/y) and waste deposited on controlled landfills is estimated at about 8.8 Mt/yr (Hg content ~8.8 t/yr).

The estimated mercury contents of municipal waste is based on the Toolkit default input factors (low end estimate 1g Hg/t waste) which may not necessarily reflect the waste contents of Nigeria. Specific data for Nigeria are not available.

Industrial waste regulations in Nigeria are considered incomplete and, where they exist, weakly enforced. As a result, many industries discharge solid waste in an uncontrolled manner in the countryside while untreated and potentially highly toxic liquid effluents are discharged to local waterways; open gutters, drains, streams, lakes, estuaries and lagoons.

As an example, it has been estimated that about 100 million litres of used crankcase oil is disposed from

mechanics workshops, industries, power stations and commercial houses each year. There are no schemes for collection and treatment so it follows that this quantity is discharged carelessly into drains and onto open ground.

Medical and special wastes are typically separated from other wastes in Nigeria. The country incinerates medical wastes and uses a thermal desorption unit (TDU) to treat drill cuttings from the oil and gas industry. Other hazardous wastes are exported to developed countries for treatment in accordance with the provisions of the Basel Convention because appropriate treatment facilities are not available in Nigeria.

Incinerators for the treatment of medical waste are located as follows:

- Lagos State University Teaching Hospital (LUTH).
- University College Hospital (UCH) Ibadan.
- Oshodi Local Government Area.
- Idu National Teaching Hospital, Lagos.
- University of Ilorin Teaching Hospital.
- Federal Medical Centre, Owo, Ondo State.
- National Institute of Medical Research, Yaba, Lagos.
- National Orthopedic Hospital, Igbobi, Lagos.
- Federal Medical Centre, Gombe.
- NAFDAC Laboratory, Kaduna.
- Ahmadu Bello University Teaching Hospital, Zaria.
- National Orthopedic Hospital, Enugu.
- National Orthopedic Hospital, Dala.
- Privately owned Incinerators e.g. DEL Waste Management Company Limited, Onne, Rivers State; and Boskel Thermal Process Engineering and Environmental Management, Port Harcourt, Rivers State.

The **DEL waste management company** is located in Port-Harcourt, Rivers State and has 115 staff. The company deals with both medical and industrial wastes. The wastes are collected in two hundred and seventy-one (271) offshore containers in line with world best practice. The wastes are treated using an incinerator and 5 TDUs. Residues are then deposited in dump pit at the company premises.

The incinerator has the capacity to treat 500 kg of waste per hour and is used to treat non-recyclable waste such as medical waste. The incinerator has a primary chamber which deals with solid waste and the secondary chamber which deals with flue gases. The incinerator has bag filter and scrubbers that control flue gases at temperature of 180 °C with the aid of cooling tower.

Each of the TDUs is automated and has the capacity to treat waste contaminated with hydrocarbon at the rate of 2.5 tonnes of per hour. The waste passes via a shaker, for the removal of unwanted coarse material such as stones, to the TDU that rotates whilst the waste inside it is heated to 345-400 °C to dissociate the hydrocarbons from the solid matrix. The extracted oil is reused while the fine dust or ash from which the hydrocarbons have been removed moves to the mixer through the cooling tower and is subsequently used for soil reclamation, road construction and constructing interlocking tiles.

BOSKEL Thermal Process Engineering and Environmental Management is an indigenous Nigerian company which has being operating since 1989 at Port Harcourt, Rivers State. The company specialised in thermal process engineering and environmental management and has designed and built thermal processing systems and incinerators for indigenous institutions such as Lagos University Teaching Hospital and NAFDAC and has exported some systems and incinerators to countries like Oman.

Figure 21: Inventory team and staff of DEL Waste Management during the site visit

Based on information provided by the DEL Waste Management Company Limited and Boskel Thermal Process Engineering and Environmental Management, the following estimates for waste incineration have been derived:

- An estimated 105,569 t of ***medical waste*** is incinerated each year with and the estimated mercury input 2,534 kg Hg/yr,
- An estimated 138,240 t of ***hazardous waste*** is incinerated each year based on information provided by the. From this extrapolated activity rate the estimated mercury input is 3,318 kg Hg/yr.
- An estimate 1,440,000 t of ***municipal/general*** waste is incinerated each year with an estimated mercury input of 7,200 kg Hg/yr

There is insufficient information to quantify less formal disposal of industrial waste.

Disposal of human corpses is traditionally carried out by burial in cemeteries. Crematoria are not in conformity with Nigeria culture but some corpses are burnt in disasters such as fires and motor accidents.

The annual death rate used in the inventory is calculated from the death rate of 12.9 in every 1000 population stated in Knoema website. With a population of 182,200,000, this gives annual deaths of 2,350,380 of which an estimated 240 are cremated, with an estimated mercury input of 0.6 kg per year, and 2,350,140 buried, with an estimated mercury input of 5875.35 kg mercury per year.

Mercury in end-of-life and obsolete electrical and electronic equipment is of considerable concern in Nigeria because the quantities of such equipment imported into the country are increasing rapidly and have resulted in this becoming the fastest growing component of the solid waste stream.

One of the major concerns related to e-waste management, particularly in Nigeria, is the dumping of electrical and electronics products from developed countries. For instance, large quantities of used computers and general electronics find their way into Nigeria due to activities of private businessmen. A study by the Basel Action Network in conjunction with Basel Convention Coordinating Centre for the African Region (BCRCC) Nigeria, established that Nigeria imports about 500,000 used computers annually through the port of Lagos alone (BAN, 2005). About 25% of the imports are functional used computers while the remaining 75% are unserviceable.

The unserviceable components might have some recycling value but products such as personal computers and televisions may contain heavy metals, including mercury (see Table 12 below) and organic compounds that render them hazardous and requiring special attention that is typically not available. While such equipment may be the subject of uncontrolled

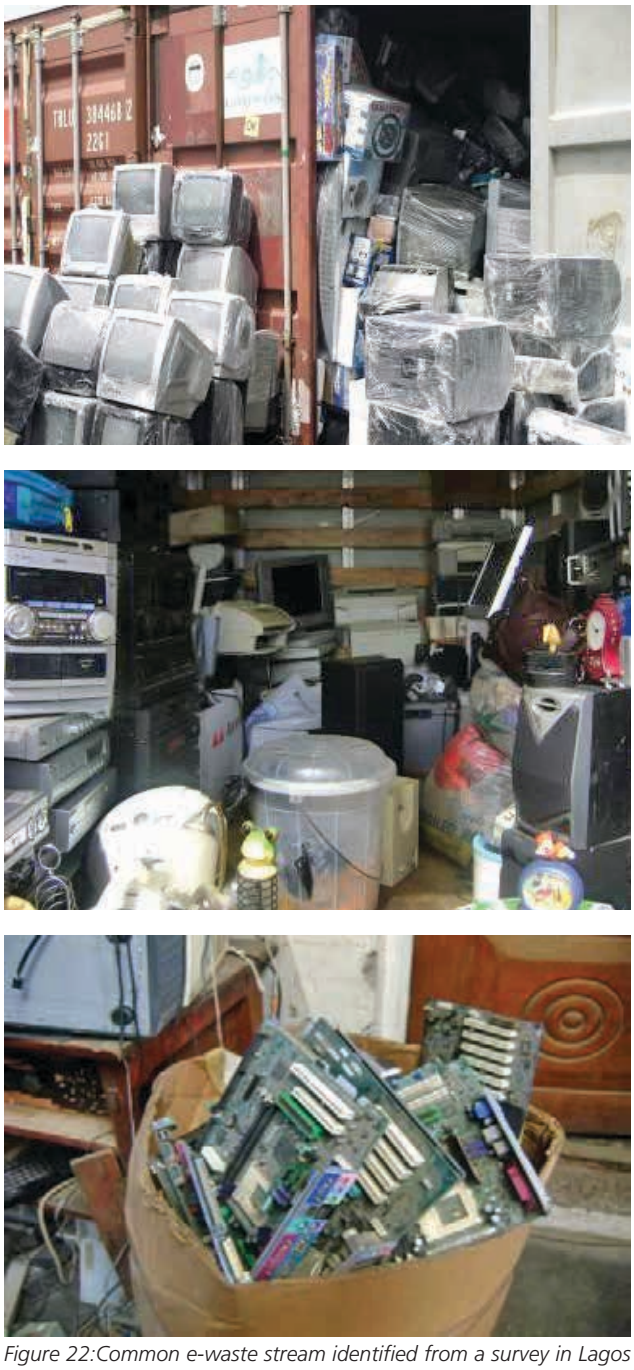


Figure 22:Common e-waste stream identified from a survey in Lagos (SRADev, 2009)

recovery and recycling processes that may discard acids, sludges and mercury in order to recover metal content (Borthaku and Singh, 2012), it is more often discarded with municipal waste (BAN, 2005). E-wastes that are landfilled produce toxic fumes when burned and also release contaminated leachates that eventually pollute the groundwater (Osibanjo and Nnorom, 2007).

TABLE **12**

Mercury Lamps in Electronic Devices

Device	Mercury content product range (mg)
Multi-media monitor	75.0
LCD display monitor	2.5
	7.5
	30.0
LCD TV flat panel	2.5
	7.5
	30.0
Digital picture frame	2.5
LCD Projector	75.0
Laptop/notebook	2.5
	30.0
Fax/copier/printer	2.5
	30.0
Fax	2.5
Scanner	2.5
Copier	30.0
	2.5
Camcorder/camera	7.5
Audio equipment	2.5
DVD/VCR players	2.5
Telephones	2.5

Source: from (AEA, 2007)

Waste water treatment is only available in larger urban areas. The total volume of waste water treated each year is estimated from data provided by the Abuja Environmental Protection Board (AEPB) in 2016 as 394,200,000 m^3 waste water per year. From this, the estimated mercury input is calculated as 2,070 kg Hg/yr. There is insufficient information available to calculate the quantity of sewage sludge incinerated in Nigeria but the volume is thought to be small.

Waste management challenges in Nigeria have been attributed to poverty, high population and rapid urbanization and growth rates compounded by a weak and underfunded infrastructure (Walling et al. 2004). It is also suggested that the management of solid waste in Nigeria cities continues to pose serious challenges due to the absence of appropriate and organized waste management culture and technologies, arising from financial, political instability, lack of policy on waste management and technological constraints (Al-Hanbali et al., 2011; Ibijoke and Alo, 2010; Butu and Mshelia, 2014).

The Federal Government, through the FMEnv and aided by UNIDO, is promoting the implementation of a National Policy on Solid Waste Management together with an Integrated Waste Management Programme (IWMF). These will be implemented through public-private partnerships in major cities nationwide. The programme includes key infrastructure, such as material recovery facilities, composting plants, incinerators where needed, landfill cells, methane recovery systems, leachate treatment facilities and plastic recovery plants.

In order to reduce solid waste volumes and boost recycling, the Government of Nigeria is also introducing Extended Producer Responsibility (EPR) in the beverages and e-waste sectors. It is expected that the programme will be extended to batteries and waste tyres UNIDO is supporting work on the EPR for e-waste.

2.2.8 Mercury in Oil and Gas

Many hydrocarbons contain mercury. Detectable mercury components of crude oils include elemental mercury and a range of mercury compounds including mercuric chloride and sulphide; dimethyl- and diethylmercury, and asphaltenes (tars). In the case of natural gas and natural gas liquids, mercury is likely to be present as elemental mercury.

Mercury levels in crude oil and gas vary widely, both between and within reservoirs and geographical areas. Mercury levels within some fields are reported to vary from less than 0.01µg/Nm3 to more than 5000 µg/Nm3. Typical mercury concentrations in natural gas from the Niger delta are reported at about10 µg/Nm3 (www.jmcatalysts.com).

The main concerns associated with mercury in oil and gas are:

- Corrosion of process equipment
- Emissions to the environment
- Exposure of workers to high levels of mercury during maintenance operations
- Difficulty in disposal of mercury contaminated equipmentPotential liabilities resulting from mercury contaminated product streams

Mercury release to the atmosphere during natural gas production occurs during flaring and through gas cleaning and drying. Additionally, mercury rich solid waste is also produced during processing. Mercury is highly mobile and bonds to metal surfaces with which it comes into contact. The implication is that any mercury that enters a gas processing plant will be distributed across process and waste streams.

Mercury associated with crude oil is released to the atmosphere, in wastewater streams and in solid waste streams during its extraction, transportation and processing.

Mercury is detrimental to the refining process because of its abilities to amalgamate with other metals; to 'poison' catalysts, and to cause liquid-metal embrittlement (cracking) with metals such as aluminium, a particular problem for LNG & LPG cryogenic heat exchangers made of aluminium alloy. Elemental mercury may concentrate in drains and other low points of process plants as a result of its high density and tendency to agglomerate and 'bead'. For these reasons, mercury may be captured in mercury removal units either installed on production well-heads, to avoid problems arising during pipeline transportation, or installed at refineries prior to the oil and gas entering processing and refining. Nevertheless, a small fraction of the mercury may persist through the refining process and this tends to concentrate and collect the mercury components and direct the emissions to air release, petroleum products, waste-water and waste-solids. In 2001, the USEPA estimated that US petroleum refineries were responsible for approximately 11 tons of mercury release annually.

During refinery distillation, elemental mercury vapour is predominantly distributed in liquefied petroleum gas (LPG) and light distillate streams but mercury can also be found in the residual fraction, which also contains the majority of the insoluble and inorganic mercury salts.

The mercury concentrations in hydrocarbon products are typically of the order of a few parts per billion but fuel oils, particularly higher-viscosity residual oils such as bunker fuels, may contain considerably higher levels of mercury than either other 'lighter' products or the crude oil from which it was refined. Mercury persisting in hydrocarbon products will be emitted to the atmosphere during combustion.

Oil and gas production in Nigeria plays a dominant role in the economy and accounts for about 90% of domestic earnings.

A 2016 NNPC report estimates recoverable crude oil reserves at 37 billion barrels. The reserve base is expected to increase due to additional exploration and appraisal drilling. Already, over 900 million barrels of crude oil of recoverable reserves have been identified. Nigeria also has an estimated 159 trillion cubic feet (Tcf), (4.5 trillion cubic metres), of proven natural gas reserves, giving the country one of the top ten natural gas endowments in the world.

The NNPC Monthly Petroleum Information Report (2015) states that annual crude oil extraction was 108,575,075 t and from this the estimated mercury input is calculated for the inventory as 369 kg Hg/yr. The report states that, in the same year, a total of 3,053,689 t of crude oil was refined in Nigeria giving an estimated mercury input of 10 kg Hg/yr. The reported consumption of heavy oil and petroleum coke was 5,167,000 t (Hg input ~103 kg Hg/yr), whereas the consumption of lighter oil fractions (petrol, diesel, kerosene, etc. was reported at 10,975,405 t most of which was used for transport (Hg input ~22 kg Hg/yr).

The average activity rate of natural gas extracted and processed in Nigeria in 2015 & 2016 was 77,665,280,000 Nm^3/yr giving an estimated mercury input of 7,77 kg Hg/yr. Natural gas combustion in Nigeria was reported at 36,501,920,000 Nm^3/yr of raw or only pre-cleaned gas (Hg input ~365 kg Hg/yr) and 3,809,120,000 Nm^3/yr of cleaned consumer quality gas (Hg input ~1 kg Hg/yr) (NNPC Petroleum Information Reports for 2015 & 2016). Cleaned gas consumption was in power generation, industrial processing and for domestic purposes.

Due to a lack of utilization infrastructure, a considerable portion of natural gas production is flared. Considerable efforts have been made in recent years to reduce this but about 40% of the natural gas produced is still flared, representing an estimated 418,9 terajoules of energy in 2014 (US statistics division accessed on www.knoema.org). A further 12% is re-injected to enhance oil recovery. The World Bank estimates that Nigeria accounts for 12.5% of the World's total gas flaring (NNPC 2016).

Of the 606 oil fields in the Niger Delta area, 355 are on-shore while the remaining 251 are offshore. Of these, 193 are currently operational while 23 have been shut or abandoned as a result of poor prospectivity or drying up of the wells. Outside the Niger Delta, a total of 28 exploratory oil wells have been drilled all showing various levels of prospectivity. These wells include two (2) discovery wells in Anambra State, one (1) discovery well in Edo State and Benue State each and Twenty-four (24) wells in the Chad Basin. However, production is yet to commence from any of these prospects.

The downstream operations cover crude oil/gas conversion into refined and petrochemical products and finer chemicals, and gas treatment as well as transportation and marketing of the petroleum products. The downstream plants under the Nigerian National Petroleum Corporation (NNPC) include the four refineries with a total installed capacity of 445,000 b/d; two in Port Harcourt (210,000 b/d), and one each in Warri and Kaduna (125,000 b/d and 110,000 b/d respectively). Production infrastructure also includes three petrochemical plants, in Warri and Kaduna,. as well as 5000 kilometres of pipeline network, 21 storage depots and 9 Liquefied Petroleum Gas (LPG) depots.

The **Nigeria Liquefied Natural Gas Company** (NLNG) was incorporated as a limited liability company on May 17, 1989, to harness Nigeria's vast natural gas resources producing liquefied natural gas (LNG) and natural gas liquids (NGLs) for export. The NLNG establishment was backed by NLNG Act of 2004. The Federal Government is the largest shareholder with 49% of stock. Shell, Total and Eni hold 25.6, 15 and 10.4 % of stock respectively.

The NLNG has wholly–owned subsidiaries that include: Bonny Gas Transport (BGT) Limited and NLNG Ship Management Limited (NSML). With six trains currently operational, NLNG's plant, on Bonny Island in Rivers State, is capable of producing 22 million tonnes per annum (MTPA) of LNG, and 5 MTPA of NGLs (LPG and Condensate) from 3.5 billion (standard) cubic feet per day (Bcf/d) of natural gas intake. NLNG's near term expansion plans include construction of a seventh train to complement the existing six train structure. When this is in operation the company's total production capacity will rise to 30 million tonnes per annum (MTPA) of LNG.

Figure 23: Section of Kaduna refinery

Figure 24: Section of Eleme petrochemical facility

The NLNG is the leading Nigeria's efforts to eliminate gas flaring, NLNG's operations have helped reduced Nigeria's Flaring Profile from 65 % to about 40 %.

The company also supplies about 40% of the annual domestic LPG (Cooking Gas) consumption. Its operations utilize mercury-containing catalysts. Since commencement, in order to be environment friendly, the Company ships (after obtaining due permits as specified under the Basel Convention guidelines/regulations) all spent catalysts abroad to catalyst –recycling plants in Europe and the US Source: www.nlng.com).

2.2.9 Contaminated Sites

The inventory and assessment of contaminated sites does not form part of the UNEP Toolkit (UNEnvironment, 2017) but does form part of the MIA. The MIA process is expected to provide highlights of any known or identifiable contaminated sites and/or to develop appropriate strategies for identifying and assessing mercury contaminated sites.

No studies or assessments focusing on mercury contamination of the environment have been identified. Studies of land contamination in Nigeria have been largely confined to the assessment of pollution arising from oil spills and oil well fires (see, for example, United Nations Environment Programme, 2011). Efforts to remediate the environment following the ASGM-related lead poisoning events in Zamfara point to significant lead contamination (see, for example, Blacksmith Institute, 2011) but did not measure mercury concentrations.

A number of academic studies have highlighted:

- the association of elevated concentrations of heavy metals, including mercury, in soils in the proximity of oilfield infrastructure (Iwegbue et at. 2006);
- the contamination of the environment by suites of heavy metals, with which mercury is often associated, around former sites of smelting and roasting operations producing non-ferrous metals (; Alo and Olanipekun A. 2006; Ogundiran et al., 2012);
- heavy metal concentrations in the environment in the vicinity of municipal waste dumps (Adelekan and Alawode, 2011); and
- dumpsites receiving clinical waste that may contain broken mercury–containing clinical thermometers and medical devices (Ibijoke and Alo, 2010).

These studies, when combined with the inventory results, provide a preliminary indication of sites that have the potential to be contaminated by mercury and so warrant attention in any more detailed assessment of mercury contamination of the environment.

Sites with the potential to be contaminated by mercury would thus include:

- Sites of ASGM activity;
- Sites of current and former coal-fired power plants and industrial boilers;

- Sites of current and former smelting and roasting processes used in the production of non-ferrous metals;
- Waste incineration sites;
- Sites of cement clinker production;
- Waste disposal sites including sites used for the recover, recycling and reclamation of materials;
- Sites of current and former bauxite extraction and processing;
- Sites of oil and gas exploration and exploitation activities, including sites where residual oils such as bunker fuels are handled and stored;.
- Sites where mercury-added products are stored either prior to distribution or at end-of-life prior to disposal, including storage at healthcare facilities and dental clinics.

In many of these cases, mercury contamination is likely to be associated with a broad suite of other contaminants and, like them, may extend significantly beyond the limits of the activities giving rise to the pollution.

It needs to be emphasised that these potentially contaminated sites would have to be confirmed through scientific study and robust laboratory analysis. Thereafter, risk assessment would be required to identify the contaminated sites posing the greatest risks to human health and the environment and to select the most practicable and economically viable remediation techniques for such sites.

While there is experience in the decontamination of contaminated materials through the use of such techniques as thermal desorption, there are currently no facilities in Nigeria for the interim storage or disposal of mercury waste. It follows that capacity for safe handling, storage and re-packing of such waste or legacy stocks of contaminated soils will need to be developed as part of any efforts to treat contaminated sites. Furthermore, the costs of transportation for wastes to be shipped overseas and for treatment and environmentally sound disposal in approved facilities, as well as for the national and international permitting requirements under the Basel Convention guidelines for transboundary shipment of hazardous waste, will need to be factored into remediation programme budgets.

2.3 SUMMARY OF INVENTORY RESULTS

Nigeria's inventory of mercury emissions and releases was developed using the UNEP Toolkit Inventory Level 2. The Toolkit is based on mass balances for each mercury release source type. Inventory Level 2 works with pre-determined 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 mercury inputs and releases data in available literature and other relevant data sources.

It must also be remembered that the inventory provides only a preliminary assessment and precautionary estimates used in the inventory, particularly with regard to mercury-added products, may result in overestimates of mercury emissions and releases for these sub-categories.

Stakeholders that made data available for the different sectors highlighted in the Toolkit Inventory Level 2 were: FMOH, FMITI, MMSD, NESREA, NAFDAC, TCN, NCS, NBS, AEBP and LAWMA, Hospitals, Non-Governmental Organization such as SRADev-Nigeria, Academia and the private sector.

2.3.1 Mercury Releases and Significant Source Types Present in Nigeria

Table 13 shows the mercury release sources identified as present or absent in the country. Only source types positively identified as present are included in the quantitative assessment.

TABLE **13**

Identified Mercury Release Sources

Source category	Exists? (y/n/?)
Source category: Extraction and use of fuels/energy sources	
Coal combustion in power plants	Y
Other coal use	Y
Mineral oils - extraction, refining and use	Y
Natural gas - extraction, refining and use	Y
Other fossil fuels - extraction and use	Y
Biomass fired power and heat production	Y
Geothermal power production	?
Source category: Primary (virgin) metal production	
Mercury (primary) extraction and initial processing	N
Gold (and silver) extraction with mercury amalgamation processes	Y
Zinc extraction and initial processing	Y
Copper extraction and initial processing	N
Lead extraction and initial processing	Y
Gold extraction and initial processing by methods other than mercury amalgamation	Y
Aliminium extraction and initial processing	Y
Other non-ferrous metals - extraction and processing	?
Primary ferrous metal production	Y
Source category: Production of other minerals and materials with mercury impurities	
Cement production	Y
Pulp and paper production	Y
Production of lime and light weight aggregates	Y
Source category: Intentional use of mercury in industrial processes	
Chlor-alkali production with mercury-technology	N
VCM production with mercury catalyst	N
Acetaldehyde production with mercury catalyst	N
Other production of chemicals and polymers with mercury	N
Source category: Consumer products with intentional use of mercury	
Thermometers with mercury	Y
Electrical switches and relays with mercury	Y
Light sources with mercury	Y
Batteries with mercury	Y
Biocides and pesticides with mercury	Y

Source category	Exists? (y/n/?)
Paints with mercury	Y
Cosmetics and related products with mercury	Y
Source category: Other intentional product/process use	
Dental mercury-amalgam fillings (b	Y
Manometers and gauges with mercury	Y
Laboratory chemicals and equipment with mercury	Y
Mercury metal use in religious rituals and folklore medicine	Y
Miscellaneous product uses, mercury metal uses, and other sources	Y
Source category: Production of recycled metals ("secondary" metal production)	
Production of recycled mercury ("secondary production")	?
Production of recycled ferrous metals (iron and steel)	Y
Production of other recycled metals	Y
Source category: Waste incineration	
Incineration of municipal/general waste	Y
Incineration of hazardous waste	Y
Incineration of medical waste	Y
Sewage sludge incineration	Y
Informal waste burning	Y
Source category: Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	Y
Diffuse disposal under some control	N
Informal local disposal of industrial production waste	Y
Informal dumping of general waste*1	Y
Waste water system/treatment*2	Y
Source category: Crematoria and cemetaries	
Crematoria/cremation	Y
Cemeteries	Y

Source: FMENV 2017

An aggregated presentation of the results for main groups of mercury release sources is presented in Table 14 below.

TABLE **14**

Results for Main Groups of Mercury Release Sources

Source category	Calculated Hg output, Kg/y							
	Air	Water	Land	By-products and impurities	General waste	Sector specific treatment/ disposal	Total releases by source category	Percent of total releases *3*4
5.1: Extraction and use of fuels/energy sources	2,369.6	229.3	-	388.3	-	161.4	3,149	2%
5.2: Primary (virgin) metal production	4,396.1	850.3	6,730.2	270.0	35.9	6.7	12,289	9%
5.3: Production of other minerals and materials with mercury impurities*1	2,518.5	-	-	836.0	-	836.0	4,191	3%
5.4: Intentional use of mercury in industrial processes	-	-	-	-	-	-	-	0%
5.5: Consumer products with intentional use of mercury (whole life cycle)	17,557.2	6,027.9	18,858.1	-	29,075.6	-	71,519	54%
5.6: Other intentional product/process use*2	2,510.5	5,676.9	2,492.9	52.7	5,483.5	1,790.6	18,007	14%
5.7: Production of recycled metals	7.0	-	7.2	-	7.0	-	21	0%
5.8: Waste incineration and burning	17,462.3	-	-	-	-	729.1	18,191	14%
5.9: Waste deposition/ landfilling and waste water treatment*3*4	1,448.0	3,223.5	10,880.0	-	207.0	-	15,758	2%
5.10: Crematoria and cemeteries	0.6	-	2,350.1	-	-	-	2,351	2%
SUM OF QUANTIFIED RELEASES*3*4	**48,270**	**14,145**	**30,439**	**1,547**	**34,809**	**3,524**	**132,733**	**100%**

Source: FMENV 2017

Table 15 provides the estimated mercury releases from all source categories present. The key mercury releases here are releases to air (the atmosphere), to water (marine and freshwater bodies, including via waste water systems), to land, to general waste, and to sectors specific waste. An additional output pathway is "by-products and impurities" which designate mercury flows back into the market with by-products and products where mercury does not play an intentional role.

TABLE **15**

Estimated Mercury Releases from all Source Sub-categories

C	Sub-C	Source category	Exists? (y/n/?)	Calculat. Hg input	Calculated Hg output, Kg/y					
					Air	Water	Land	By-products and impurities	General waste	Sector specific treatment/ disposal
5.1		**Source category: Extraction and use of fuels/energy sources**								
	5.1.1	Coal combustion in power plants	Y		227	0	0	0	0.0	76
	5.1.2	Other coal use	0		0	0	0	0	0	0
	5.1.3	Mineral oils - extraction, refining and use	0		121	74	0	0	0	8
	5.1.4	Natural gas - extraction, refining and use	0		**521**	155	0	388	0	78
	5.1.5	Other fossil fuels - extraction and use	0		0	0	0	0	0	0
	5.1.6	Biomass fired power and heat production	0		**1500**	0	0	0	0	0
	5.1.7	Geothermal power production	0		0	0	0	0	0	0
5.2		**Source category: Primary (virgin) metal production**								
	5.2.1	Mercury (primary) extraction and initial processing	N		0	0	0	0	0	0
	5.2.2	Gold (and silver) extraction with mercury amalgamation processes	Y		**4095**	710	655	0	0	0
	5.3.3	Zinc extraction and initial processing	0		0	0	0	0	0	0
	5.3.4	Copper extraction and initial processing	0		0	0	0	0	0	0
	5.3.5	Lead extraction and initial processing	0		0	0	0	0	0	0
	5.3.6	Gold extraction and initial processing by methods other than mercury amalgamation	Y		270	135	6075	270	0	0
	5.3.7	Aliminium extraction and initial processing	0		8	6	0	0	36	6
	5.3.8	Other non-ferrous metals - extraction and processing	?		0	0	0	0	0	0
	5.3.9	Primary ferrous metal production	Y		23	0	0	0	0	1
5.3		**Source category: Production of other minerals and materials with mercury impurities**								
	5.3.1	Cement production	Y		**2508**	0	0	836	0	836

C	Sub-C	Source category	Exists? (y/n/?)	Calculat. Hg input	Calculated Hg output, Kg/y					
	5.3.2	Pulp and paper production	Y		0	0	0	0	0	0
	5.3.3	Production of lime and light weight aggregates	Y		11	0	0	0	0	0
5.4		**Source category: Intentional use of mercury in industrial processes**								
	5.4.1	Chlor-alkali production with mercury-technology	N		0	0	0	0	0	0
	5.4.2	VCM production with mercury catalyst	N		0	0	0	0	0	0
	5.4.3	Acetaldehyde production with mercury catalyst	N		0	0	0	0	0	0
	5.4.4	Other production of chemicals and polymers with mercury	N		0	0	0	0	0	0
5.5		**Source category: Consumer products with intentional use of mercury**								
	5.5.1	Thermometers with mercury	Y		**4019**	**6028**	4019	-	6028	0
	5.5.2	Electrical switches and relays with mercury	Y		**3903**	0	5204	-	3903	0
	5.5.3	Light sources with mercury	Y		190	0	190	-	254	0
	5.5.4	Batteries with mercury	Y		**9446**	0	9446	-	18891	0
	5.5.6	Biocides and pesticides with mercury	Y		0	0	0	-	0	0
	5.5.7	Paints with mercury	Y		0	0	0	-	0	0
	5.5.8	Cosmetics and related products with mercury	0		0	0	0	-	0	0
5.6		**Source category: Other intentional product/process use**								
	5.6.1	Dental mercury-amalgam fillings (b	Y		18	404	0	53	211	211
	5.6.2	Manometers and gauges with mercury	Y		**2493**	**3739**	2493	0	3739	0
	5.6.3	Laboratory chemicals and equipment with mercury	Y		0	**1533**	0	0	1533	1580
	5.6.4	Mercury metal use in religious rituals and folklore medicine	Y		0	0	0	0	0	0
	5.6.5	Miscellaneous product uses, mercury metal uses, and other sources	Y		0	0	0	0	0	0
5.7		**Source category: Production of recycled metals ("secondary" metal production)**								
	5.7.1	Production of recycled mercury ("secondary production")	?		0	0	0	-	0	0
	5.4.2	Production of recycled ferrous metals (iron and steel)	Y		7	0	7	0	7	0

C	Sub-C	Source category	Exists? (y/n/?)	Calculat. Hg input	Calculated Hg output, Kg/y					
	5.4.2	Production of other recycled metals	Y		0	0	0	0	0	0
5.8		**Source category: Waste incineration**								
	5.8.1	Incineration of municipal/general waste	Y		**1296**	0	0	0	0	144
	5.8.2	Incineration of hazardous waste	Y		**2986**	0	0	0	0	332
	5.8.3	Incineration of medical waste	Y		**2280**	0	0	0	0	253
	5.8.4	Sewage sludge incineration	Y		0	0	0	0	0	0
	5.8.5	Informal waste burning	Y		**10900**	0	0	0	0	0
5.9		**Source category: Waste deposition/landfilling and waste water treatment**								
	5.9.1	Controlled landfills/ deposits	Y		88	1	0	0	0	0
	5.9.2	Diffuse disposal under some control	N		-	-	-	-	-	-
	5.9.3	Informal local disposal of industrial production waste	Y		0	0	0	-	-	-
	5.9.4	Informal dumping of general waste*1	Y		**1360**	**1360**	10880	-	-	-
	5.9.5	Waste water system/ treatment*2	Y		0	**1863**	0	0	207	0
5.10		**Source category: Crematoria and cemetaries**								
	5.10.1	Crematoria/cremation	0		1	0	0	-	0	0
	5.10.2	Cemeteries	0		0	0	2350.14	-	0	0
SUM OF QUANTIFIED RELEASES:					48,270	14,145	30,439	1,547	34,809	3,524

The individual mercury release sub-categories contributing the highest mercury emissions to the atmosphere are:

- Open waste burning (~11 t Hg/yr),
- Batteries with mercury (~9.5 t Hg/yr),
- Gold production with mercury amalgamation (~4.1 t Hg/yr) and
- Thermometers (~4.0 t Hg/yr).

The following inventory sub-categories contribute most to flows of mercury into water (water environment + waste water system):

- Thermometers (~6 t Hg/yr),
- Manometers and gauges (~4 t Hg/yr),
- General waste water (original Hg source was primarily intentional mercury uses ~2 t Hg/yr) and
- Laboratory use (chemicals/equipment: ~2 t Hg/yr).

Mercury inputs to society are shown in Table 16. They are understood here to be the amounts of mercury emitted or released through economic activity in the country. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, fluorescent light bulbs, etc. It also includes mercury mobilised via extraction and use of raw materials which contains mercury in trace concentrations.

For waste categories, the "inputs" are calculated to show the distribution of mercury in waste through the different waste treatment activities and to calculate releases from these activities, though waste is not an original source of input mercury into society (except in case of waste import). Waste "inputs" are marked in italics.

TABLE **16**

Summary of Mercury Inputs to Society

Category no.	Source category	Estimated Hg input, Kg Hg/y, by life cycle phase (as relevant)		
		Production phase*1	Use phase	Disposal phase
5.1	**Main category - Extraction and use of fuels/energy sources**			
5.1.1	Coal combustion in large power plants		303	
5.1.2	Other coal combustion		0	
5.1.3	Extraction, refining and use of mineral oil	369	135	
5.1.4	Extraction, refining and use of natural gas	7,767	3,651	
5.1.5	Extraction and use of other fossil fuels	0		
5.1.6	Biomass fired power and heat production	1,500	96	
5.1.7	Geothermal power production	0		
5.2	**Main category - Primary (virgin) metal production**			
5.2.1	Primary extraction and processing of mercury	0		
5.2.2	Gold and silver extraction with the mercury-amalgamation process	21,000		
5.2.3	Zinc extraction and initial processing	****		
5.2.4	Copper extraction and initial processing	0		
5.2.5	Lead extraction and initial processing	?		
5.2.6	Gold extraction and initial processing by other processes than mercury amalgamation	6,750		
5.2.7	Aluminium extraction and initial processing	55		
5.2.8	Extraction and processing of other non-ferrous metals	?		
5.2.9	Primary ferrous metal production	24		
5.3	**Main category - Production of other minerals and materials with mercury impurities**			
5.3.1	Cement production	4180		
5.3.2	Pulp and paper production	0		
5.3.3	Lime production and light weight aggregate kilns	11		
5.3.4	Others minerals and materials	?		
5.4	**Main category – Intentional use of mercury as an auxiliary material in industrial processes**			
5.4.1	Chlor-alkali production with mercury-technology	0		

Category no.	Source category	Estimated Hg input, Kg Hg/y, by life cycle phase (as relevant)		
		Production phase*1	Use phase	Disposal phase
5.4.2	VCM (vinyl-chloride-monomer) production with mercury-dichloride (HgCl2) as catalyst	0		
5.4.3	Acetaldehyde production with mercury-sulphate (HgSO4) as catalyst	0		
5.4.4	Other production of chemicals and polymers with mercury compounds as catalysts	0		
5.5	**Main category - Consumer products with intentional use of mercury**			
5.5.1	Thermometers with mercury		20,093	
5.5.2	Electrical and electronic switches, contacts and relays with mercury		13,009	
5.5.3	Light sources with mercury		634	
5.5.4	Batteries containing mercury		37,783	
5.5.6	Biocides and pesticides		0	
5.5.7	Paints		0	
5.5.8	Pharmaceuticals for human and veterinary uses		0	
5.5.8	Cosmetics and related products		0	
5.6	**Main category - Other intentional products/process uses**			
5.6.1	Dental mercury-amalgam fillings		879	
5.6.2	Manometers and gauges		12,000	
5.6.3	Laboratory chemicals and equipment		4,645	
5.6.4	Mercury metal use in religious rituals and folklore medicine	?		
5.6.5	Miscellaneous product uses, mercury metal uses and other sources	?		
5.7	**Main category - Production of recycled metals**			
5.7.1	Production of recycled mercury ("secondary production)	0		
5.7.2	Production of recycled ferrous metals (iron and steel)	21.2047		
5.7.3	Production of other recycled metals	0		
5.8	**Main category – Waste incineration**			
5.8.1	Incineration of municipal/ general waste			***7,200***

Source: FMENV 2017

2.4 Implications of the Inventory Results for Nigeria as a Party to the Minamata Convention

It is clear from the results of the inventory set out above that Nigeria, 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, Nigeria 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 Nigeria. 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, Nigeria 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. In preparing such measures, Nigeria will need to consider whether the registration of any exemptions is required.

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. Nigeria 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 Nigeria during inventory work. In meeting the obligation set out in paragraph 6, Nigeria 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 Zamfara and the increasing importance of ASGM, Nigeria will need to determine whether it considers the sector as more than insignificant. If it so determines, then actions to address the obligations set out in paragraph 3 and Annex C will be required.

With regard to ***Article 8: Emissions***, the inventory has identified the economic importance to Nigeria of a number of the point source categories listed in Annex D. Significant expansion of the use of coal in power generation is planned and a number of coal-fired power plants are under construction or consideration. Problems in industrial gas supply has prompted a number of industries to switch, or plan to switch, to the use of coal. Production of cement clinker is increasing, including with the use of coal. Increasing urbanisation and pressing problems in waste disposal may prompt an expansion of waste incineration. Finally, while no smelting and roasting processes for the production of non-ferrous metals have been identified, current exploration efforts for gold may result in industrial-scale production that might involve smelting. It follows that Nigeria 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***, Nigeria 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***, Nigeria may not need to consider measures under this article as manufacturing processes constituting a use allowed a Party have not been identified. The obligations set out in this article might need to be considered in drawing up an action plan for ASGM that includes efforts to manage the trade of mercury to that sector.

With regard to ***Article 11: Mercury wastes***, the inventory highlights the significance to the total mercury emissions and releases in Nigeria of the disposal of mercury-containing products, including products imported at or near end-of-life. It follows that Nigeria, as a Party also to the Basel and Bamako Conventions, 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 recognised. 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 needs 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, Nigeria 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 3.
POLICY, REGULATORY AND INSTITUTIONAL FRAMEWORK ASSESSMENT

3.1
Institutions Relevant for Sound Management of Chemicals (Including Mercury) in Nigeria, and their Mandates.

The **Federal Ministry of Environment (FMEnv)** was established in June 1999 as a legal entity by the President of the Federal Republic of Nigeria to ensure effective coordination of all environmental matters, previously fragmented and resident in different line ministries. It succeeded the Federal Environment Protection Agency established in 1988.

The mandates of the Ministry are to:

1. Prepare a comprehensive National Policy for the protection of the environment and conservation of natural resources, including procedures for environmental impact assessment of all developmental projects, and towards the overall goal of sustainable development;

2. Prepare in accordance with the National Policy on Environment, periodic master plans for redevelopment of environmental science and technology and advise the Federal Government on the financial requirements for the implementation of such plan;

3. Prescribe standards for and make regulations on hazardous chemicals and wastes, water quality, effluent limitations, air quality, atmospheric protection, ozone layer protection and noise pollution;

4. Advise the Federal Government on National Environmental Policies and priorities, the conservation of natural resources and sustainable development and scientific and technological activities affecting the environment and natural resources;

5. Promote cooperation in environmental science and conservation technology with similar bodies in other countries and with international bodies connected with the protection of the environment and the conservation of natural resources;

6. Cooperate with Federal and State Ministries, Local Government, statutory bodies, academia and United Nations agencies on matters and facilities relating to the protection of the environment and the conservation of natural resources; and

Monitor and enforce environmental protection measures.

Within these mandates, the FMEnv is the Designated National Authority for the implementation of chemical related Multilateral Environmental Agreements (MEAs) including the Minamata Convention on Mercury. The Ministry coordinates all activities relating to chemicals management and, with the Federal Ministry of Health, co-chairs the **National Committee on Chemicals Management (NCCM)** that ensures cooperation and collaboration for the sound management of chemicals, including mercury, in Nigeria across participating agencies, organisations and stakeholders. A **Technical Coordinating Committee (TCC)** advises the NCCM on all technical matters relating to chemicals safety and management.

The Ministry also controls and manages the disposal of obsolete hazardous chemicals and wastes, gives technical support to state ministries and Agencies of Environment to promote management of hazardous

chemicals and waste, collects data on hazardous chemicals and wastes for information dissemination and maintains national hazardous chemicals and waste data bank, collaborates with relevant National, Regional and International Agencies and NGOs on chemicals management programmes in consultation with all stakeholders, and initiates fund, coordinates and promotes research activities on hazardous chemicals and waste management in the environment in collaboration with relevant stakeholders.

The **National Environmental Standards and Regulations Enforcement Agency (NESREA)** was established as a parastatal of the FMENV by an Act of parliament in July 2007. The NESREA Act repeals the FEPA Act Cap F10LFN 2004. NESREA is charged with the responsibility of enforcing all laws, guidelines, policies, standards and regulations on environment in Nigeria. It also has the responsibility to enforce compliance with provision of international agreements, protocols conventions and the treaties on the environment.

The Agency also has the responsibility of enforcing biodiversity conservation and sustainable development laws as well as liaisons with relevant stakeholders within and outside of Nigeria, on matters pertaining to enforcement of environmental policies, regulations, laws and standards.

The (NESREA) Act of 2007 is the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources. Section 7e of the Act mandated the Agency to enforce compliance with regulations on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector.

Regulations pertinent to mercury are listed below:

- Electrical and Electronic Sector Regulation on E-waste Management.
- National Effluent Limitation Regulations.
- National Environment Protection (Pollution abatement in industries and facilities producing waste) Regulations (1991).
- The Harmful Waste (Special Criminal Provisions Etc.) Decree 1988, Decree No. 42.
- Hydrocarbon Oil Refineries Act, Cap H5, LFN 2004.
- Oil in Navigable Waters Act, Cap 06, LFN 2004.
- Associated Gas Re-injection Act, Cap 20, LFN 2004.
- Petroleum Act, Cap P10, LFN 2004.

National Oil Spill Detection and Response Agency (NOSDRA), a parastatal of the FMEnv, was established as the institutional framework to implement the National Oil Spill Contingency Plan, which was initiated in 2006. The National Oil Spill Contingency Plan is a blueprint/manual for checking oil spill through, containment, recovery, and remediation/restoration.

The **Federal Ministry of Health** (FMOH) is to assess the short- and long-term health impact of chemicals and provide expertise for treatment of people exposed to chemicals. The Ministry formulates, disseminates, promotes, implements, monitors and evaluates health policies of the Federal Government of Nigeria using the National Health Act and collaborating with the National Council on Health (NCH), States and Local Governments, the Private Sector and Civil Society Organizations in formulating health policies. It is the coordinating body of the Federal Government on issues of health.

The **National Agency for Food and Drug Administration and Control** (NAFDAC), a parastatal under FMOH regulates and controls the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, medical devices and packaged water (known as regulated products) and chemicals. The National Agency for Food and Drug Administration and Control (NAFDAC) was established by Decree 15 of 1993 as amended, now Act. Cap N1 Laws of the Federation of Nigeria (LFN) 2004, to regulate and control the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, chemicals, detergents, medical devices and all drinks including packaged water.

The **Ministry of Mines and Steel Development (MMSD)** is charged with the following responsibilities:

1. Formulating, disseminating and implementing related policies on mining.
2. Providing information and knowledge to enhance investment in the sector.
3. Regulating operations in the solid minerals sector.
4. Generating appropriate revenue for the government.

The **Ministry of Foreign Affairs (MFA)** cooperates with the Federal Ministry of Environment to co- ordinate

all protocol issues relating to international aspects of chemicals management, such as signing of MEAs, participation in relevant international agreements and conventions including the negotiations of the Minamata Convention on Mercury. The Ministry is also responsible for the formulation, dissemination and implementation of related policies on foreign affairs.

The **Federal Ministry of Science and Technology (FMST)** facilitates the development of science and technology apparatus to enhance the pace of socio-economic development of the country through appropriate technological inputs into productive activities in Nigeria. Considering that chemical use is common in science and technology this ministry has an important role to play in the choice of technology for all chemicals' use in Nigeria including mercury. The Ministry is also responsible for the formulation, dissemination and implementation of related policies on technology.

The **Federal Ministry of Labour and Employment (FMLE)** is concerned with occupational health and safety issues related to the use and handling of chemicals at the workplace. The Ministry conducts workplace monitoring to ensure safe working environments for workers. Its important position, it has great influence on the safety of workers in Nigeria. The Factory Inspectorate Division (FID) of the Ministry identifies and controls the hazards to workers in the workplace from exposure to chemicals and other labour associated risks.

The **Federal Ministry of Agriculture and Rural Development (FMARD)** is concerned with the use of agricultural chemicals for the benefit of securing food supplies in Nigeria. The Livestock and Pest Control Department of the Ministry is responsible for collecting and disseminating information on pesticides management to farmers i.e. proper use and alternatives to unsafe pesticides. The Ministry is also responsible for the formulation, dissemination and implementation of related policies.

The **Federal Ministry of Industry, Trade & Investment (FMITI)** is statutorily responsible for formulating and implementing policies, programmes and incentives for industrial development of the country including chemical industries. The Ministry carries out its mandate through its relevant departments and agencies including:

i. Industrial Development Department (IDD);
ii. Commodities and Produce Inspectorate Department (CPI);
iii. Standards Organisation Of Nigeria (SON);
iv. Consumer Protection Council (CPC).

The **Standards Organisation Of Nigeria** (SON); is a parastatal supervised by FMITI. The organization is tasked with the responsibility to designate, establish and approve standards in respect of metrology, materials, commodities, structures and processes for the ISO certification of products in commerce and industry throughout Nigeria. In essence, all products produced or imported into Nigeria have to meet the standards set by SON before they can be used in Nigeria. The organisation was set up under Decree No.56 of 1974 as amended by Decree No.32 of 1984 and subsequently re-enacted as Cap.412 of the 1990 Laws of the Federation. The basic aim of the enactment is to establish an umbrella organization for the standardization of methods and products in Nigerian industries and to provide for other matters relating thereto.

The **Consumer Protection Council (CPC)**. is a parastatal supervised by the FMITI. The Council is responsible for educating, enlightening and protection of consumers' rights in Nigeria. The Rights protected by the Council are; the right to satisfaction of basic needs, right to safety, right to information on products, right to choose the product to purchase, right to redress, right to consumer education, right to consumer representation and right to a healthy environment.

The Federal Ministry of Justice (FMJ) is generally concerned with the development of laws and regulations including with respect to chemicals management. It also deals with the ratification and domestication of MEAs in the country. The Ministry is also responsible for the formulation, dissemination and implementation of related policies.

The Federal Ministry of Finance (FMF) provides, within its national mandate, financial assistance to fulfil obligations to those MEAs to which Nigeria is a Party. The Ministry is also responsible for the formulation, dissemination and implementation of related policies on finance.

The **Federal Ministry of Information** provides Nigerian citizens with "credible and timely information on government activities, programmes and initiatives"

and to create the technological environment for Nigeria's socio-economic development.

The **Federal Ministry of Petroleum Resources** is mandated to transform the oil and gas industry for the increased benefit of Nigeria and its people through effective implementation of policies on hydrocarbon exploration, exploitation, production, distribution and utilization in accordance with international standards. Its vision is to maximize the net economic benefit from oil and gas resources and enhance the social and economic development of the people while meeting the nations needs for fuel at competitive cost, accomplishing all in an environmentally acceptable manner. The ministry has the following parastatals under it:

- **Nigerian National Petroleum Corporation** (NNPC)
- **Department of Petroleum Resources (DPR)** is the technical department of the ministry that regulates and monitors activities of the oil and gas industry. It cooperates with the FMENV to regulate the petroleum sector with regard to hazardous materials, consignors, consignees of drilling chemicals, exploration, formulation, refineries, distribution, import and export of petroleum products.
- Nigerian Nuclear Regulatory Authority (NNRA)
- Petroleum Equalization Fund Management Board PEF(M)B
- Nigerian Content Development Management Board (NCDMB)
- Petroleum Technology Development Fund (PTDF)
- Petroleum Training Institute (PTI)
- Petroleum Products Pricing Regulatory Agency (PPPRA)

The **Nigerian Ports Authority (NPA),** an agency under Federal Ministry of Transport, is responsible for ensuring the safe transportation, loading, unloading, and handling of goods, including chemicals, carriage, embarking/disembarking of passengers in or from sea going vessels. Efforts are made to ensure that all hazardous materials imported and exported are transported in accordance with international regulations, and the manufacturer's recommendations.

The Nigeria Custom Service (NCS): is responsible for ensuring that chemical imports and exports are in accordance with national and international regulations. The agency controls the imports and exports of all goods including chemicals. The Customs and Excise Management Act (CEMA) Cap 45, Law of the Federation of Nigeria, 2004 vests Legal Authority in the Nigeria Customs Service to act on behalf of the Federal Government of Nigeria in all Customs matters. This is supported by supplementary legislation, including:

- Customs and Excise (Special Panel and other Provisions) Cap 45, Law of the Federation of Nigeria, 2004;
- Customs Duties (Dumped and Subsidized Goods) Act Cap 87 Laws of the Federation of Nigeria;
- Nigeria Pre-shipment Inspection Decree No. 36 of November, 1979 further amended by Decree No. 11 of 19th April, 1996;
- Decree No. 45 of 1st June, 1992 as amended by Decree No, 77 of 29th August, 1993;
- Customs and Excise Management (Amendment) Act No. 20 of 2003; and
- Constitution of the Federal Republic of Nigeria.

The law relating to Customs Agents is contained in the Customs and Excise Management Act (CEMA) Cap 45, Law of the Federation of Nigeria, 2004 and the Customs and Excise Agents (Licensing) Regulations 1968 (Legal Notice 95/1968 as amended).

The **National Authority on Biological and Chemical Weapons Convention (NABCWC)** is located in the office of the Secretary to the Government of the Federation, which ensures the implementation of Nigeria's obligations under the chemical weapons convention.

The **Ecological Fund Office (EFO)**: is an intervention facility established to address the many ecological problems ravaging communities across the country. The Ecological Fund was established to provide resources for the amelioration of ecological problems such as soil erosion, flood, drought, and desertification as well as environmental pollution.The enabling statutes have over the years placed the Fund under the control of the head of the federal government; to be disbursed and managed in accordance with such directives as may be issued from time to time.

The **National Bureau of Statistics (NBS)** is mandated under the Statistics Act of 2007 to coordinate statistical operations of the national statistical system in the production of official statistics in all the Federal Ministries, Departments and Agencies, State Statistical Agencies and Local Government Councils. It is overseen by a governing board of 15 members. The chair of the Board is appointed by the President on the recommendation of the Minister of National Planning Commission.

State Ministries of Environment, and their parastatals, for the 36 states of Nigeria including the Federal Capital Territory (FCT), Abuja, administer environmental regulations at state level.

Other institutions that are relevant to mercury management and safety in Nigeria include:

Academic and research institutions such as:
- the Basel Convention Coordinating Centre for Training and Technology Transfer for the African Region,
- the Federal Ministry of Environment-University of Lagos Linkage Centre for Excellence,
- National Research Institute for Chemical Technology (NARICT).

Non-governmental organisations such as**:**
- Nigerian Environmental Society (NES),
- SRADEV-Nigeria,
- Women Environmental Programme (WEP),
- Waste Management Society of Nigeria (WAMASON),
- Friends of the Environment (FOTE).

Professional organisations such as:
- Institute of Public Analysts of Nigeria (IPAN),
- Institute of Chartered Chemists of Nigeria (ICCON).

Business and trade organisations such as:
- Miners Association of Nigeria,
- Manufacturers Association of Nigeria (MAN)

3.2 Administrative and Regulatory Frameworks for Mercury Management in Nigeria

The **National Secretariat and Focal Point** for the Minamata Convention on Mercury is provided by the FMEnv as the UNEP focal point and the coordinating body for all chemicals-related issues in Nigeria. The Ministry advises the Federal Government of Nigeria on mercury management issues including developing methodologies for meeting Nigeria's obligation under the treaty, reviewing the adequacy of measures undertaken to meet the agreement's objective, reporting to the Conference of Parties of the Convention, liaising with related international organisations and agencies and promoting cooperation with relevant stakeholders. The national secretariat of the convention is also engaging the ministries of environment of the 36 states of Nigeria, including the Federal Capital Territory of Abuja, are part of activities undertaken on mercury management to ensure information dissemination to the grassroots.

Inter-ministerial and stakeholder coordination through the National Committee on Chemicals Management (NCCM) ensures commitment by all national stakeholders to the sound management of chemicals, including mercury, in Nigeria. The life cycle management of mercury as a hazardous substance requires an approach that leverages the coordinated support of key institutions and stakeholders for clearly-defined, pragmatic, and affordable strategies. Ensuring the proper and sustainable management of the mercury life cycle in Nigeria will require a comprehensive, realistic, and well-coordinated framework in which all relevant departments of government, businesses, and institutions involved in the management of chemicals and wastes are engaged. Table 17, below, highlights those institutions and key stakeholders with responsibilities at various stages in the life-cycle management of mercury in Nigeria.

TABLE **17**

Life-cycle Management of Mercury in Nigeria

S/N	Life Cycle	Regulators/Stakeholders
1	Managing Importation	NCS, NAFDAC, FMENV,NESREA, DPR, SON, FMOH
2	Managing Placement in the Market	NAFDAC, NESREA, CPC
3	Production, Commercial Sale and Distribution/ Own Use	NAFDAC, SON, NESREA, Power, FMITI, FML&E
4	Managing Transport and Distribution	NESREA, NAFDAC, FRSC, NPF, NOSDRA, NIMASA, NPA
5	Managing Display	NAFDAC, NESREA, CPC
6	Managing use	FMENV, NAFDAC, NESREA, FMLE, FMoH, FMARD, FMMSD, NOSDRA, FMITI
7	Managing Disposal	FMENV, NESREA, SEPAs, Sanitation and Waste Management Agencies

The **monitoring, surveillance and enforcement** of environmental regulations is mandated to NESREA. It is expected that these enforcement-related activities will ensure that stakeholders, including those engaged in activities that use, emit or release mercury, understand the Minamata Convention's requirements and take appropriate action. Monitoring results will also provide the information base on the types and levels of mercury exposure risks. Close relationships with NCS and NBS are important to the establishment and maintenance of key datasets for managing and reporting Nigeria's efforts to comply with the treaty.

The **management of accidents and emergencies** is the responsibility of the National Emergency Management Agency (NEMA) and, together with the Occupational Safety and Health Division of the FMLE, has the mandate to respond to accidents and emergencies, in close collaboration with other relevant ministries, departments and agencies.

Technical and analytical infrastructure support for implementation and monitoring efforts is provided by laboratories within government agencies, industries, universities and research institutes, and some private entities. The number of laboratories available to support work on the Minamata Convention is small and most will require upgrading and capacity enhancement to meet specific challenges presented by mercury.

A summary situation analysis of the current institutional capacity for mercury management in Nigeria is set out in Table 18.

TABLE **18**

Summary Situation Analysis of the Current Institutional Capacity for Mercury Management in Nigeria

SECTOR	RELEVANT INSTITUTIONS	Regulations	Administrative Structure	Technical Infrastructure	Finance	Research and Data Management
ENVIRONMENT	Federal Ministry of Environment	• Not Applicable • Absence of National Policy and Guidelines on Mercury Management	• National Secretariat and Focal Point for the Minamata Convention on Mercury • National Secretariat for the NCCM • Administrative structure in place but could be improved.	• No certified analytical laboratory, • Limited on spot assessment equipment • Absence of Chemical Emergency and Response Management centres	• Inadequate funds for chemicals (including mercury) management Programme,	• Laboratory for quality research is absent • Absence of National registers of chemicals and emergency incidence • Absence of Pollutant Release and transfer register
ENVIRONMENT (Compliance, Monitoring and Enforcement)	National Environmental Standards and Regulation Enforcement Agency (NESREA)	Inadequate specific regulations for enforcement of mercury related issues.	Administrative structure for monitoring and enforcement is present but could be improved.	• Laboratories that requires upgrading. • Inadequate testing equipment. • Inadequate infrastructure for monitoring and enforcement.	Inadequate funding	• Inadequate laboratories for quality research on alternatives to mercury.
HEALTH	Federal Ministry of Health	Not Applicable	• Administrative structure in place but could be improved. • Information sharing with relevant stakeholders is weak.	Centre for Disease control present	Inadequate funding	• No research undertaken • No data available

SECTOR	RELEVANT INSTITUTIONS	Regulations	Administrative Structure	Technical Infrastructure	Finance	Research and Data Management
HEALTH (Compliance)	National Agency for Food and Drug Administration and Control (NAFDAC)	Inadequate regulations for effective compliance	• Officers are at the port to control import • Administrative structure is present but could be improved. • Information sharing is weak.	• Laboratories that require upgrading. • Inadequate testing equipment.	Inadequate funding	• No research undertaken • Data on chemical (including mercury) import is available but should be regularly updated and made accessible to the public.
PROTECTION OF CONSUMERS	Consumer Protection Council (CPC)	Inadequate Regulations	Administrative structure is present but could be improved.	Inadequate Technical Infrastructure	Inadequate Funding	• No research undertaken • No data available
Workers Safety and Health	Federal Ministry of Labour and Employment	No regulations on chemicals management	Administrative structure is available, however it needs improvement and synergy with other relevnt stakeholders	Inadequate testing equipments, inadequate infrastructure for monitoring compliance and enforcement in workplace	Inadequate funding	No research undertaken.
MINING (artisanal gold and coal mining)	Ministry of Mines and Steel Development	Not applicable	Administrative structure is present but could be improved.	Inadequate Technical Infrastructure	Inadequate funding	• No research undertaken • Inadequate database
QUALITY CONTROL	Standards Organisation of Nigeria (SON) Consumer Protection Council (CPC)	Inadequate Regulations Inadequate Regulations	Administrative structure is present but could be improved. Administrative structure in place but could be improved.	Inadequate Technical Infrastructure Administrative structure in place	Inadequate Funding Inadequate Funding	• Inadequate database • No research undertaken
OIL& GAS	National Oil Spill Detection and Response Agency (NOSDRA)	Inadequate Regulations	Administrative structure is present but could be improved.	Inadequate capacities and technologies on oil spill cleanup, remediation and mercury related issues.	Inadequate Funding	No research undertaken Inadequate database

The existing **legal framework** for the sound management of chemicals, including mercury, and including any reforms required to meet the requirements of the Minamata Convention is set out in Table 19. Inconsistent legal drafting has resulted in overlapping mandates and responsibilities amongst regulatory authorities. This has resulted in ineffective management and oversight of some of the regulations.

TABLE **19**

Existing Legislation Relevant to Mercury Management in Nigeria

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
Article 3 on supply sources and trade Party obligations related to: • Disallow primary mercury mining once the Convention comes into force. • Identification of stocks of mercury or mercury compounds above 50 tons and sources generating stocks above 10 tons. • Disallow export and import of mercury. Except in instances stated in paragraph 6 (a&b) under the article. • Notification and consent of import/export of mercury.	NAFDAC	NAFDAC ACT No.15 of 1993-Cap NI LFN 2004	Regulate and control the importation, exportation, manufacture, advertisement, distribution, sale and use of food, drugs, cosmetics, medical devices, bottled water and chemicals; [Sec. 5(a)].	This mandate covers all types of chemicals, including the import and export of mercury	No reform needed
	NESREA	NESREA ACT No. 25 of 2007,	Enforces compliance with regulations on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector; [Sec. 7 (e)]	The NESREA mandate specifically target hazardous chemicals which mercury belongs. It therefore covers the control of mercury import and export.	
	FMENV	Rotterdam Convention Act No.15 of 2007	Rotterdam Convention Act provides for the banning and restriction of the use, export and import of hazardous chemicals and pesticides. It has provisions for the implementation of Prior Informed Consent (PIC) procedure for hazardous chemicals.	Although the Federal Ministry of Environment is the Designated National Authority for the implementation of the Rotterdam Convention in Nigeria. This Act does not give authority for its implementation to any institution. The Act gives the country the legal backing to control mercury trade and supply.	Amendment of Rotterdam Convention Act No.15 of 2007 to give authority to the Federal Ministry of Environment for its implementation
	Federal Ministry of Mines and Steel Development (FMMSD)		FMMSD has the man date for the following: • Formulating, disseminating and implementing related policies on mining, • Providing information and knowledge to enhance investment in the sector, and • Regulating operations in the solid minerals sector.		FMMSD to make law prohibiting primary mercury mining in Nigeria.

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
Article 4 on mercury-added products Party obligations related to: • Disallow manufacture, import, and export of mercury-added products of part 1 of Annex A of the Convention by 2020. • Take measures relating to mercury-added products listed in part II of Annex A of the Convention. • Discourage manufacture and distribution in commerce of new mercuryadded products. • Prevent incorporation into assembled products of mercury-added products the manufacture, import and export of which are not allowed for it.	NAFDAC	NAFDAC ACT No.15 of 1993-Cap NI LFN 2004	Regulates and controls the importation, exportation, manufacture, advertisement, **distribution, sale** and use of food, drugs, cosmetics, medical devices, bottled water and chemicals; [Sec.5(a)].	This mandate covers the manufacture, import and export of mercury added products in cosmetics and medical devices (non-electronic and electronic measuring devices)	Enact law banning the manufacture, import or export of mercury added products in cosmetics, pesticides, biocides, topical antiseptics and medical devices by 2020.
	NESREA	NESREA ACT No. 25 of 2007 National Environmental (Chemicals, Pharmaceuticals, Soap and Detergent Manufacturing Industries) Regulations, S. I. No. 36 of 2009	This Act enforces compliance with regulations on the importation, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector; [Sec.7 (e)]. This regulation controls the use of hazardous chemicals in manufacturing processes and regulates the emissions and releases of hazardous substances from manufacturing processes.	The NESREA Act and the regulation S.I. No 36 of 2009 cover the use of appropriate measures to control the use of mercury or mercury compounds in manufacturing processes and emissions/ releases of mercury from manufacturing facilities.	
	SON	SON Act No. 18 (1990)	This Act designates, establishes and approves **standards in respect of metrology, materials, commodities, structures and processes for the certification of products in commerce and industry THROUGHOUT Nigeria** [Sec.4(b)].	The Act will make it possible not to allow the use of mercury or mercury compounds in manufactured or imported products..	SON to develop standards and regulations excluding mercury from batteries, electrical/mea suring devices listed in Part 1 of Annex A of the convention, and prohibit the manufacture, import and export of such products in Nigeria.
Article 5 on manufacturing processes in which mercury or mercury compounds are used Party obligations related to: • Disallow the Use of mercury or mercury compounds in processes listed in Part 1 of Annex B of the Convention after the phase-out date.	NESREA	NESREA ACT No. 25 of 2007	Enforces compliance with regulations on the importation, exportation, production**, distribution, storage, sale**, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector; [Sec.7 (e)]. Section 8(1)(k) empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution. These regulations prohibit the releases of hazardous substances into the air, land or water of Nigeria beyond approved limits set by the Agency	The NESREA Act covers the use of appropriate measures to control the use of mercury or mercury compounds in manufacturing processes and emissions/releases of mercury from manufacturing facilities. However, it does not ban the intentional use of mercury in manufacturing processes.	• NESREA to formulate appropriate regulations banning the use of mercury or mercury compounds in the production of chloralkali by 2025, Acetaldehyde by 2018 and any manufacturing process in which mercury or mercury compounds is intentionally used.

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
• Restrict the use of mercury or mercury compounds in the processes listed in Part 2 of Annex B. • Address emissions and releases of mercury and mercury compounds from these processes. • Discourage the use of mercury or mercury compounds in new processes.		National Environmental (**Chemicals, Pharmaceuticals, Soap and Detergent Manufacturing Industries)** Regulations, 2009. S. I. No. 36.		These regulations cover the control of emissions and releases of mercury and mercury compounds from manufacturing processes.	
	FMENV	S.I 9 National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations 1991			
		Environmental Impact Assessment (EIA) ACT. CAP E12, LFN 2004.	Section2 (1) requires an assessment of public or private projects likely to have a significant impact on the environment.	The Act will make it possible not to allow the use of mercury or mercury compounds in new processes.	
Article 7 on artisanal and small-scale gold mining • Party obligations related to: Reduction/elimination of use of mercury in, and the emissions and releases to the environment of mercury from mining and processing. • Notification to the Secretariat when determining ASGM and processing is more than insignificant. • Preparation of a national action plan addressing items in Annex C for Parties which recognize that ASGM in their territory is more than insignificant	Federal Ministry of Mines and Steel Development	FMMSD has the mandate for the following: • Formulating, disseminating and implementing related policies on mining, • Providing information and knowledge to enhance investment in the sector, and • Regulating operations in the solid minerals sector.			Enact law formalizing the ASGM sector, and restricting/ prohibiting t he use of mercury in ASGM.
	NESREA ACT	Enforces compliance with regulations on the importation, exportation, production**, distribution, storage, sale**, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector; [Sec.7 (e)].	The NESREA Act covers the use of appropriate measures to control the emissions/releases of mercury from the process		
		Section 8(1)(k) empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances and other forms of environmental pollution.			
		National Environmental **(Mining and Processing of Coal, Ores and Industrial Minerals)** Regulations, 2009. S.I. No. 31	This Regulation seeks to minimize pollution from mining and processing of coal, ores and industrial minerals.		The regulations should be reviewed to include provision for the reduction/elimination of the use of mercury and mercury compounds in mining and processing.

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
Article 8 on emissions Party obligations related to: • Controlling emissions of mercury or mercury compounds from relevant sources as listed in Annex D. • Use of best available techniques and best environmental practices to control and reduce emissions from new sources. • Use of appropriate measures to control and reduce emissions from existing sources. • Establishment of an inventory of emissions from relevant sources.	**NESREA**	**NESREA ACT** No. 25 of 2007,	Section 7 provides authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitory and regulatory measures.	The Act contains appropriate provisions to control emissions of mercury/mercury compounds from sources listed in annex D	NESREA to make sectoral regulations covering the mercury emission source categories contained in Annex D of the convention to control emission of mercury and mercury compounds from such sources.
		S.I.9 National Environmental Protection (Pollution Abatement in industries and Facilities Generating Wastes) Regulations 1991	This regulation prohibits the releases of hazardous substances into the air, land or water of Nigeria beyond approved limits and mandated industrial facilities to install pollution abatement equipment in their facilities.	This regulation covers control of mercury/mercury compound's emissions.	
Article 9 on releases Party obligations related to: • Identification of relevant point source categories not addressed in other provisions of the Convention. • Controlling releases of mercury or mercury compounds to land or water. • Establishment of an inventory of releases from relevant sources.	FMENV	Environmental Impact Assessment (EIA) ACT. CAP E12,LFN 2004	Section2(1) requires an assessment of public or private projects likely to have a significant impact on the environment.	Through this Act new point sources of mercury releases will be identified (if any) and mitigating measures put in place.	
		Harmful Waste (Special Criminal Provisions) Act Cap HI LFN 20	The Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, and or waters of Nigeria.	This Act covers the regulation of releases of mercury and mercury compounds to land and water from point sources listed in Annex D.	
	NESREA	NESREA ACT No. 25 of 2007,	Section 7 provides authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitoring and regulatory measures.	This mandate will make discovery of new point sources of mercury and mercury compound releases possible.	NESREA to make regulations mandating industries to report to it any new point sources of mercury and mercury compound releases in their facility and set mercury releases limit values from these sources.
	NIMASA	NIMASA ACT (2007)	Control and prevent marine pollution; Inspect ships for the purposes of maritime safety, maritime security, maritime labor and prevention of Maritime pollution.	This mandate appears to cover the regulation of all types of MARINE transportation, which is the main means of transporting chemicals into the country.	

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
	NPA	NPA ACT Decree No. 38 (1999) LFN	Develop, own, and operate ports and harbors; Provide safe and navigable channel; Offer cargo handling and storage services; Maintain Port facilities and equipment; Ensure safety and security; Prevention and handling of marine accidents and pollution.	This mandate appears to cover the regulation of all types of MARINE transportation, which is the main means of distributing chemicals.	
Article 10 on environmentally sound interim storage of mercury, other than waste mercury Party obligations related to: Environmentally sound interim storage of mercury and mercury compounds pending use, noting that the article applies only to such mercury and mercury compounds intended for a use allowed to the Party under this Convention.	NESREA	**NESREA ACT** No. 25 of 2007,	Enforces compliance with regulations on the importation, exportation, production**,** distribution, storage, sale, use, **handling** and disposal of hazardous chemicals and waste other than in the oil and gas sector; [Sec.7 (e)]. Section 27 prohibit without lawful authority, the discharge of hazardous substances into the environment.	These provisions of the Act cover the safe handling and storage of mercury.	NESREA should make regulations for interim storage of mercury and mercury compounds in an environmentally sound manner.
Article 11 on mercury wastes Party obligations related to: • Environmentally sound management of mercurywastes. • Recovery, recycling, reclamation or direct re-use only for a use allowed or for environmentally sound disposal. • Application of the Basel Convention on Control of Trans boundary • Movements of Hazardous Wastes and their Disposal in relation to transport of waste across international boundaries, noting that, where the Basel Convention does not apply to such transport, a Party shall take into account relevant international rules, standards and guidelines.	FMENV NESREA	Harmful waste (special criminal provisions) ACT. CAP H1,LFN 2004.	This Act prohibit, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, and or waters of Nigeria	This Act allow for environmentally sound management and disposal of mercury waste	FMENV should domesticate Basel Convention to strengthen the implementation of Harmful waste (special criminal provisions) ACT. CAP H1,LFN 2004.

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
Article 12 on contaminated sites Party obligations related to: • Developing strategies for the identification and assessment of contaminated sites. • Actions to reduce risks from contaminated sites shall be done in an environmentally sound manner.	FMENV		FMENV has the mandate to secure a quality environment conducive for good health and well-being of fauna and flora	This mandate covers the development of appropriate strategies for identifying, assessing, and remediating sites contaminated by mercury and mercury compounds.	
	NOSDRA	NOSDRA ACT No. 15 of 2006	Safe, timely, effective and appropriate response to major or disastrous oil pollution; be responsible for surveillance and ensure compliance with all existing environmental legislation and the detection of oil spills in the petroleum sector; receive reports of oil spillages and coordinate oil spill response activities throughout Nigeria; strengthen the national capacity and regional action to prevent, control combat and mitigate		
Article 13 on financial resources and mechanism Party obligations related to: Undertaking to provide, within its capabilities, resources in respect of those national activities intended to implement the Convention.	FMBNP FMF		FMBNP has the mandate to formulate and prepare long term, medium term and short term national development plans and to coordinate such plans at the Federal, States and Local government levels. The ministry also manage multilateral and bilateral economic cooperation, including development aid and technical assistance. FMF is responsible for managing the finances of the Federal government of Nigeria, including managing, controlling and monitoring federal revenues and expenditures.	Beside annual budgetary provision which is grossly inadequate, there is no established sustainable financial mechanism for sound management of chemicals in Nigeria.	There is the need to establish legislation on sustainable financial mechanism for the implementation of the convention's provisions to meet these gaps.
Article 16 on health aspects **Parties are encouraged to:** • **Promote the development and implementation of strategies and programmed to identify and protect populations at risk, setting targets for mercury exposure reduction, and public education**	FMoH		FMoH has the mandate to formulate, disseminate, promote, implement, monitor, and evaluate health policies of the Federal government of Nigeria.	The mandate of FMoH covers Nigerian obligation under the article.	NAFDAC Act should be enhanced to regulate medical devices. However there are no policy currently available and this need be formulated by the FMoH

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
• **Promote the development and implementation of science-based educational and preventive programmed on occupational exposure to mercury and mercury compounds** • **Promote appropriate health-care services for prevention, treatment and care of populations affected by the exposure to mercury and mercury compounds Establish and strengthen the institutional and health professional capacities for the prevention, diagnosis, treatment, and monitoring of health risks related to the exposure to mercury and mercury compounds**	FML&E EHORECON				
	NAFDAC	NAFDAC ACT No.15 of 1993-Cap NI LFN 2004	Regulate and control the importation, exportation, manufacture, advertisement, **distribution**, **sale** and use of food, drugs, cosmetics, medical devices, bottled water and chemicals;[Sec.5(a)].	The Act creates capacity to promote awareness amongst chemical handlers and the general public.	
Article 17 on information exchange Parties shall facilitate the exchange of: • Scientific, technical, economic and legal information on mercury and mercury compounds. • Information on the reduction or elimination of the production, use, trade, emissions and releases of mercury and mercury compounds. • Information on technical and economically viable alternatives to mercuryadded products, processes using mercury or mercury compounds and activities and processes that emit or release mercury or mercury compounds.	FMENV, FMST, FMoH, MMSD, FMARD, FMITI, FMLE, SON, CPC, IPAN , ICCON and Academia	National Policy on Chemicals Management	The policy makes provision for the establishment of National Committee on Chemical Management (NCCM) to promote information sharing on chemicals management issues.	The NCCM is an Interinstitutional arrangement for sound management of chemicals (SMC) and information exchange on chemicals management	Enactment of law to formalize the NCCM

Provision of the Minamata Convention	Relevant institution	Relevant Act, legislation and regulation	Relevant Provision	Implication for Nigeria	Proposed legal reform action (if needed)
• Epidemiological information concerning health impacts associated with exposure to mercury. This information may be exchanged directly, through the Secretariat or in cooperation with other organizations.	FMENV	CIEN Website, Established 2006	Information exchange on chemicals management	This programme encourages networking and collaboration amongst stakeholders	
Article 18 on public information, awareness and education. Parties shall, within its capabilities, promote and facilitate: • Provision to the public of available information on effects of mercury, alternatives, issues noted in Article 17, results of research, development and monitoring, and its activities to meet its obligations under the Convention. • Education training and public awareness related to the effects of exposure to mercury and mercury compounds on human health and the environment.	National Orientation Agency (NOA)	NOA has the following mandates: • Ensure that Government programmes and policies are better understood by the general public. • Mobilize favourable opinion for such programs and policies. • Encourage informal education through public enlightenment activities and programme			Enactment of law to formalize the NCCM
	Federal Ministry of Information and Culture (FMI&C)	FMI&C has the following mandates: • To develop, design. Institutionalize appropriate and generally acceptable public information and communication policies which will promote information management and control in a democratic society. • To provide professional information services which will project the image and reputation of the Federal Government and her people as a responsible society			

3.3. Implications of the Assessment Results for Nigeria as a Party to the Minamata Convention

It is clear from the results of the assessment set out above that Nigeria, 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***, Nigeria may need to amend mining regulations to prohibit and prevent any possible future mercury mining. 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, while the NAFDAC Act 15 (1993) and the NESREA Act 25 (2007) are considered adequate, it is considered necessary to amend the Rotterdam Convention Act 15 (2007) giving authority to FMEnv for its implementation.

With regard to ***Article 4. Mercury-added products***, Nigeria will need to consider what amendments to the NAFDAC Act 15 (1993) are necessary to meet the obligation in paragraph 1 of the article with regard to the import and export of mercury-added products listed in Annex A Part I. In preparing such measures, Nigeria will need to consider whether the registration of any exemptions is required. The SON will need to develop standards and regulations excluding mercury from such products.

In determining administrative arrangements for continuing inventory work, close collaboration between national and state focal points and the NCS would be of value, improving the identification and quantification of mercury-containing product imports. The FMOH will be instrumental in strategies to phase-out and dispose of mercury-containing medical devices and in efforts to phase-down the use of dental amalgam. In collaboration with the FMOH, the National Secretariat will need to determine whether a proposal for listing mercury-containing medical instruments that are not currently listed in Annex A Part I is warranted pursuant to paragraph 7.

With regard to ***Article 5. Manufacturing processes in which mercury or mercury compounds are used***, in particular paragraph 7, Nigeria may need to consider amendments to NESREA Act 25 (2007) such 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***, Nigeria will need to determine whether it considers the sector as more than insignificant. If it so determines, then close collaboration between a number of ministries, departments and agencies as well as non-government organisations will be required to develop and implement a national action plan in accordance paragraph 3 and Annex C. The MMSD is mandated to develop and implement mining policies while NESREA seeks to minimise mining-related pollution through the National Environmental (Mining and Processing Coal, Ores and Industrial Minerals) Regulations (2009).

With regard to ***Article 8: Emissions,*** Given current policies and strategies to boost economic development through the expansion of the use of coal in power generation and by encouraging investment in a number of industries, Nigeria will need to consider amendments and additions to NESREA Act 25 (2007) 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***, Nigeria will need to consider what changes may be necessary to industry licensing and permitting arrangements, including the Environmental Impact Assessment (EIA) Act (2004), the Harmful Waste (Special criminal provisions) Act (2004) and the NESREA Act 25 (2007) to meet obligations to control releases, including through the use of release limit values, the adoption of best available techniques and best environmental practices, and the application of multi-pollutant control strategies.

With regard to ***Article 11: Mercury wastes***, Nigeria, as a Party also to the Basel and Bamako Conventions, will need to consider appropriate measure to meet obligations set out in paragraph 3. In particular, the

domestication of the Basel Convention to strengthen the Harmful Waste (Special criminal provisions) Act (2004). Regulations for interim storage of wastes might be required within NESREA Act 25 (2007).

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 recognised. Further work, within the mandate of FMEnv, to develop an appropriate strategy for identifying and assessing such sites will be needed to meet obligations set out in paragraphs 1 and 2 and will require the participation and engagement of a number of ministries, departments and agencies as well as industry and NGO stakeholders.

With regard to ***Article 13: Financial resources and mechanism***, Nigeria will to consider the resources needed to implement plans to meet obligations set out in the various articles of the treaty. It is likely that a mix of funding sources will be required. Some obligations of the treaty are the proper and normal business of government and will need to be planned into the work of appropriate line ministries, departments and agencies. Other actions, particularly those of a technical nature, may be financed directly by industry investments in new or expanded facilities. Other actions may find support for implementation through broader government initiatives and be supported by both local budgets and resources provided by development partners and the Financial Mechanism established in the treaty. Coordination between the NCCM, its TCC, and the Federal Ministry of Budget and National Planning will be important in identifying opportunities to link actions in support of the Minamata Convention to national development initiatives towards the Sustainable Development Goals. The National Secretariat and focal points for international organisations will have an important role in identifying opportunities for financial support from the Financial Mechanism and other development partners.

With regard to ***Article 15: Implementation and Compliance Committee***, Nigeria, on becoming a party, will need to identify the organisation and personnel with appropriate competences to represent it in the affairs of the committee and, if nominated and elected, to act as a member of the committee.

With regard to ***Article 16: Health aspects***, the inventory highlights the potential exposure to mercury of a number of population groups. These are considered in more detail in Chapter 4 below. Nigeria will need to consider strategies and programmes to identify and protect these and other populations at risk pursuant to paragraph 1. FMOH has authority to formulate, implement and evaluate health-related policies.

With regard to ***Article 17, Information Exchange***. Nigeria, on becoming a Party, will need to designate a national focal point for the exchange of information set out in paragraph 1 and including information with regard to the consent of importing Parties under Article 3. The information likely to be exchanged will likely be derived from a number of different ministries, departments and agencies so that the NCCM, as an inter-institutional arrangement for the sound management of chemicals, has the lead role in coordination. Its mandate would be strengthened by legal action to formalise the body.

With regard to ***Article 18: Public information, awareness and education***, Nigeria will need to consider the provision of public information, and education, training and public awareness measures pursuant to paragraph 1, and to assign responsibilities for their preparation and dissemination perhaps as integral parts of actions to address obligations listed above. The NCCM, as an inter-institutional arrangement for the sound management of chemicals, has the lead role in coordination. Its mandate would be strengthened by legal action to formalise the body. The Federal Ministry of Information and Culture holds the mandate for the development and communication of public information and its professional information services will be important in meeting the requirements of this article.

Also with respect to Article 18, Nigeria will need to consider mechanisms, such as pollutant release and transfer registers, and assign responsibilities for the continuing collection, management and dissemination of inventory data and information necessary to meet the reporting requirements set out in various articles as set out in Article 21. The participation of the National Bureau of Statistics, as custodian of national statistics, will likely be significant.

With regard to ***Article 19: Research, development and monitoring***, Nigeria may wish to encourage local researchers to continue and expand their research efforts towards the objectives set out in paragraph 1 and to collaborate in broader monitoring networks and research programmes. The advice of the NCCM and its TCC will be important in steering research and development efforts.

With regard to ***Article 20: Implementation Plans***, the results of this initial assessment highlight the need to develop and implement a number of action plans to address meet obligations under the treaty. Nigeria will need to assign responsibilities to key stakeholder groups for the preparation of these plans and to determine processes for the consideration, approval and transmission to the Secretariat of the Convention.

With regard to ***Article 21: Reporting***, Nigeria, as a party to the Convention, will be required to report to the Conference of the Parties, through the Secretariat, on the measures it has taken to implement the provisions of the treaty, their effectiveness and the challenges faced in meeting the objectives of the Convention. The National Secretariat for the Convention within FMEnv would have responsibility for coordinating the development and submission of reports. The NCCM would be instrumental in an effective process to engage stakeholders in report preparation and in reviewing reports, NBS datasets may be fundamental in ensuring that reporting in relation to the Minamata Convention uses national statistics consistent with other processes.

With regard to ***Article 23: Conference of the Parties***, Nigeria will need to assign responsibilities for its representation at the Conference and the process of determining its positions and opinions for that meeting and meetings of any subsidiary bodies that might be established.

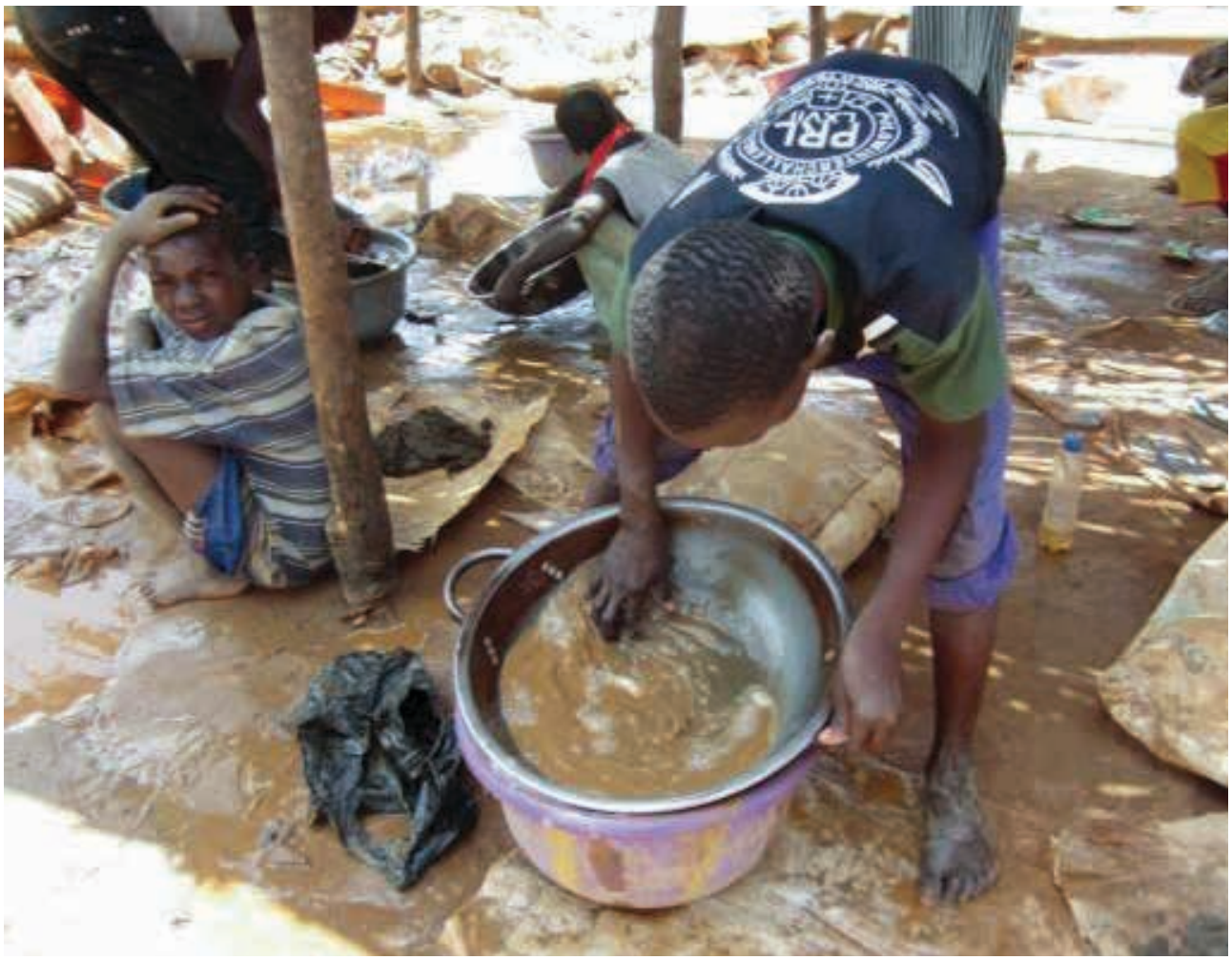


Figure 25: Artisanal and Small-Scale Gold Miners in operation in Nigeria

Chapter 4.
IDENTIFICATION OF POPULATIONS AT RISK AND GENDER DIMENSIONS

4.1
Identification of Populations at Risk and Gender Dimensions

Elemental mercury and methylmercury 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 primary health effect of methylmercury is impaired neurological development. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. Neurological and behavioural disorders may be observed after inhalation, ingestion or dermal exposure of different mercury compounds (WHO, 2017).

Generally, two groups are more sensitive to the effects of mercury. Foetuses are most susceptible to developmental effects due to mercury that can adversely affect a baby's growing brain and nervous system. They are exposed through the passage of methylmercury across the placenta from the mother. High exposure of the foetus is the result of the mother's high exposure, typically arising from her consumption of fish and shellfish or from her occupational exposure. The second group is people who are regularly exposed to high levels of mercury. This group includes populations with diets featuring significant amounts of fish and shellfish, such as those that rely on subsistence fishing, or people who are occupationally exposed (WHO,2017).

A 2014 study estimated that-19 million people in Nigeria are directly at risk of mercury poisoning, apart from the general population who might be affected due to accidental spills or industrial mishaps.The major populations at risk include miners in the ASGM sector and workers in industries identified earlier in this chapter as sources of mercury emissions and releases (SRADev, 2014).

Communities engaging in ASGM, or living close to ASGM activity, are likely to be exposed to mercury that is widely used. ASGM is largely carried out by the rural and vulnerable poor. Women for a significant proportion of the workforce and they are often accompanied by their children, some of whom also work.

The major pathway of exposure for these workers is the inhalation of mercury vapour as mercury, added to the gold ore or concentrate to create an amalgam, is volatilised as the amalgam is heated to recover the gold. Mercury may also be absorbed directly through the skin as the amalgamation process is typically done by hand without personal protective measures. Mercury

Figure 25b: Artisanal and Small-Scale Gold Miners in operation in Nigeria

amalgamation, and its subsequent burning to recover the gold, is often carried out by women, putting them in direct contact with mercury vapour releases. This process frequently takes place in the home, especially in Muslim communities under Sharia law - operational in Northern Nigeria, where women typically must stay within their family compounds. During their work at home, women are usually accompanied by their children leading to particularly high risks of exposure and health impacts to those families. Furthermore, amalgamation may be carried out on cooking stoves and using kitchen utensils that are reused in food preparation and consumption (Okoh and Daniels, 2016).

In addition, mercury lost or discarded in mine waste directly into streams at mining sites, is likely to be transformed to methylmercury and to contaminate fish and wildlife. As a result, communities living within the proximity of, and downstream of, the mining activities may experience high exposure to mercury through their food.

In similar ways, ***groups engaging in waste management activities***, typically including a significant proportion of women and children, are likely to be at risk of mercury exposure. Uncontrolled scavenging, informal recycling of discarded mercury-containing products and open burning of wastes at solid waste dump sites are likely to put women and children at particular risk.

Despite the risks to the health of women and young families, communication to these groups about the health risks they face, including from mercury exposure, is often targeted at the male heads of households, and may not reach those at particular risk. Even where it does, families may have few options to mitigate such risks or avoid the activities giving rise to exposure. It follows that if communications will need to consider mercury exposure within wider aspects of the socio-economic disadvantage of these groups and not target mercury exposure risk alone.

Mercury is also used in a variety of devices and measuring instruments in the healthcare sector. ***Healthcare workers***, may be exposed to mercury through the breakage of equipment or while bougie tubes and other devices are being filled.Improper disposal of the remains from a spill from broken devices containing mercury results in the contamination of solid waste streams and further environmental contamination (Okoh, 2015). Furthermore, mercury is also used widely for dental amalgam so that ***dental workers*** may become contaminated through the preparation of amalgam. Waste amalgam, either remaining from preparation or removed from patients is mostly discarded into solid waste or enters waste water systems, potentially contaminating waste disposal and water treatment facilities and posing risks to workers there.

4.2. Implications of the Assessment Results for Nigeria as a Party to the Minamata Convention

With regard to ***Article 4: Mercury-added products***, promotion of mercury-free alternatives products, where possible 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 such products contain. Where products remain in use, in particular within the healthcare sector, training in handling breakages and spillages of mercury, information on exposure risks, and revised procurement arrangements favouring mercury-free alternatives are likely to be important. With regard to dental amalgam, the measures set out in Part II of Annex A form the basis of a phase-down initiative.

With regard to ***Article 7 Artisanal and small-scale gold mining***, a public health strategy will be required as part of a national action plan if Nigeria considers that ASGM is more than insignificant. This strategy should include health data, training for health-care workers and awareness raising through health facilities. The national action plan would require strategies to prevent the exposure to mercury of vulnerable populations particularly children and women on child-bearing age, especially pregnant women, in communities engaged in, or effected by, ASGM.

With regard to ***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. Nigeria will wish to consider strategies and programmes to identify and protect these and other populations at risk pursuant to paragraph 1.

CHAPTER 5.
AWARENESS AND UNDERSTANDING OF WORKERS AND THE PUBLIC

5.1
Public Awareness

Creating awareness of the potential risks associated with the use of, and exposure to, mercury is key to the successful implementation of the Minamata Convention on Mercury in Nigeria. The FMEnv in close collaboration with the NCCM is currently responsible for ensuring effective risk communication and public awareness across all sectors including amongst decision makers.

Nigeria has commenced awareness programmes on the deleterious effects of mercury since the emergence of global concern on mercury hazards and the development of the Minamata Convention. The focus of these programmes has been key sectors including health, mines and steel, industry, agriculture, labour and productivity, NGOs and academia. Some of these activities are presented below:

An **ASGM regional awareness workshop** was held in May 2011 in Lagos to inform miners of mercury health impacts and to promote the use of alternatives to mercury amalgamation in ASGM. The workshop was hosted by the FMEnv with support from UNEP.

As part of this **Minamata Initial Assessment** project, an inception workshop was held in April 2015 in Abuja to raise awareness of the Minamata Convention and its objective to protect human health and the environment from anthropogenic emissions and releases of mercury. The meeting set out the aims and objectives of the MIA Project in Nigeria, encouraged stakeholder participation in the project, and provided a first forum deliberate on national strategies for the management of mercury.The event was attended by representatives from:

- FMOH, FMARD, FMITI, MMSD, FMLE, the Ministries of Foreign Affairs, Information, and Justice; NESREA, NOSDRA, National Planning Commission, TCN, SON;
- States Ministries of Environment;
- Institute of Chartered Chemist of Nigeria (ICCON), Institute of Public Analysts of Nigeria (IPAN), Chemical Society of Nigeria (CSN);
- SRADev Nigeria, Northern Youth Assembly Forum (NYAF), Women Environmental Programme (WEP), Hermon Development Foundation (HDF), Nigeria Women Agro Allied Farmers' Association (NIWAAFA), Agbekoya Farmers' Association FCT Chapter;

Academia and the media; United Nations Industrial Development Organization, and the United Nations Institute for Training and Research;

Awareness raising and sensitization activities targeting key sectors were held as follows:

1. for Health, Mines and Steel, Industry, Agriculture, Labour and Productivity, NGOs and Academia in February 2015.

Figure 26: Stakeholders at the MIA awareness raising workshop for the media and NGO

2. for ***health institutions*** on the need to phase down the use of dental amalgam in Nigeria, in May 2014 co-hosted by FMEnv and SRADev

3. for ***the media and NGOs*** on the Minamata Convention on Mercury held at Sheraton Hotel, Lagos in February 2017.The workshop was attended by 49 participants

4. for ***policy makers, the private sector and academia*** in February 2017 with 35 participants including the Deputy Chairman of the Senate Committee on Environment and other representatives of the National Assembly/Parliament.

An **NGO (European Environmental Bureau/Zero Mercury Working Group)** sponsored project on developing strategies to implement mercury added products phase-out provisions of the Minamata Convention in Nigeria being implemented by SRADev complemented government effort in awareness creation; the project sensitised ***traders, importers and users of mercury-added products*** onthe impeding ban on mercury added products and availableConvention compliant alternatives, in December 2016 at theManufacturers Association of Nigeria, House, Lagos.

A **national stakeholder's consultation** meeting to discuss and share information on mercury use and stakeholders roles in its management was held in May 2016 in Abuja, Nigeria with 46 relevant national stakeholders from Government, Academia, Non-Governmental Organizations and the media.

National stakeholder validation workshops have been held at each stage of the development of sectoral inventories and mercury profiling initiatives.

5.2
Training and Education of Target Groups and Professionals

Nigeria is a Party to the internationally-agreed chemicals and waste conventions and has shown its intention to become a Party to the Minamata Convention on Mercury, by signing the accord. It follows that public authorities with mandates relating to sound chemicals management, including mercury management, will require core officers to be trained in the development and implementation of policies, strategies and programmes, including monitoring and enforcement activities, designed to protect human health and the environment from the adverse effects of chemicals and waste. Initial activities undertaken as part of the MIA project represent a first stage in such training but further work will be required if the implementation of the convention in Nigeria is to be a success. Given the three-tier structure of governance in Nigeria, training will need to extend beyond officials in the federal ministries to those within States authorities and within Local Government.

Figure 27: Stakeholders at the MIA awareness raising workshop for the Policy makers, Academia and Private sector

Figure 28: National Stakeholders at the validation workshop

Attempts by the public sector to change the behaviour of industrial sectors engaged in mercury use and trade or implicated in the inventory as sources of mercury emissions and releases will depend on sensitising them on their responsibilities to reduce and eliminate the risks they are posing in terms of occupational health and safety, as well as broader public health and environmental degradation. Training of key groups and professionals in those industries, including through local chapters of the professional associations to which they belong, will be critical.

Civil society organisations play an important role in representing communities and raising their awareness of issues such as the risks posed by mercury, they too can be instrumental in changing behaviour and in ensuring that the design of strategies and programmes addressing mercury risks is appropriate to the communities they target. Nigeria is fortunate in having civil society organisations that are already closely engaged in seeking to reduce mercury risks and that have participated in the MIA project. Engaging additional NGOs, particularly those engaged with local communities, through training and awareness activities will greatly assist effective implementation.

Nigeria is fortunate in having scientific and socio-economic expertise in mercury within its academic and NGO communities. This expertise has been engaged in furthering the MIA project and will be an important asset in developing and implementing measures to implement the Convention in Nigeria. To support and enhance their work, it will be important to identify opportunities for them to cooperate regionally and internationally in, for example, research programme and monitoring networks.

5.3 Implications of the Assessment Results for Nigeria as a Party to the Minamata Convention

With regard to ***Articles 3, 4, 5, 8, 9, 10, 11, and 12:*** officials in the Federal and state ministries with responsibilities for the implementation of mercury management will require training and capacity building in order to implement the measures necessary to meet Nigeria's obligations. Campaigns to provide information and engage key economic sectors with regard to the replacement of mercury-containing products and processes and to the reduction of mercury emissions and releases will be important in changing their behaviour.

With regard to ***Article 7: Artisanal and small-scale gold mining***, the development and implementation of a strategy for providing information to miners and affected communities will be required as part of the national action plan necessary if Nigeria considers that ASGM is more than insignificant. As noted in Chapter 4, it will be important that information and awareness campaigns consider mercury exposure within wider aspects of the socio-economic disadvantage of these groups and not target mercury exposure risk alone. Furthermore, given the significant presence of women and children within the mining workforce and communities, it is important to ensure that awareness and education campaigns are able to address these stakeholders directly.

With regard to ***Article 11: Mercury wastes***, experience in delivering awareness and information to vulnerable communities engaged in ASGM may be useful in formulating approaches to providing information and education to communities engaged in informal waste management including the reclamation of materials from a wide range of waste products that may contain mercury.

With regard to ***Article 12: Contaminated sites***, advice to the public on avoiding risks of exposure to mercury from contaminated sites is expected to benefit from guidance to be adopted by the Conference of the Parties as set out in paragraph 2.

With regard to ***Article 18: Public information, awareness and education***, while FMEnv and the NCCM have the mandates for ensuring effective communication of mercury risks, it will be important to take advantage of existing mechanisms available through the Federal and state ministries of information, civil society organisations and the media to deliver well coordinated campaigns of information to key stakeholders and vulnerable populations.

Chapter 6.
IMPLEMENTATION PLANS AND PRIORITIES FOR ACTION

Nigeria is preparing to become a Party to the Minamata Convention on Mercury.

The **goal** of that treaty, and thus of Nigeria as a Party to it, is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

To meet its obligations under the treaty, a range of actions needs to be taken to address the many aspects of the anthropogenic use of mercury. These actions include making the necessary regulatory and administrative arrangements for the proper work of the convention at the national level; working with the private sector and investors to ensure that emissions and releases from industrial point sources are controlled and minimized; prohibiting or limiting the use of mercury-containing products and encouraging consumers to accept alternatives; assisting vulnerable populations engaged in ASGM to halt practices that have serious impacts on health and the environment; preventing mercury and mercury-containing products from entering waste streams.

The priority actions below set out an initial set of priority actions that arise from the initial assessment described in the previous chapters. Priority 1 concerns actions, largely within government, to establish a sound regulatory and administrative framework for the implementation of the treaty.

Subsequent actions arise where the inventory has identified anthropogenic emissions and releases so that Nigeria is obliged to take measures as set out in the convention. Priorities are set out in the order of convention articles, broadly reflecting the life-cycle of anthropogenic mercury. In agreeing haw best to take such actions forward, stakeholders may establish short, medium and long-term priorities that would change the order set out here.

Priority 1: Ratification and Domestication of the Minamata Convention on Mercury

Objective: Development of an effective legal and administrative framework for the implementation of the Minamata Convention

Outputs:

1. Minamata Convention on Mercury ratified;
2. National policy on mercury management developed;
3. Legal and Regulatory changes to address the Minamata Convention and the obligations set out in its articles enacted;
4. Administrative responsibilities assigned;
5. Sustainable systems for continuing and comprehensive inventory and reporting established.

Activities:

1) ***Ratification and domestication of the Minamata Convention on Mercury:*** the legal and administrative process of ratifying and domesticating the Minamata Convention on Mercury in Nigeria is underway and currently being finalized.

2) Development of 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.

In developing the policy, it will be necessary:

- to consider the implications of interactions between the policy and other national development policies including, but not limited to, policies relating to energy

generation and security; industrial development and investment; public health; rural livelihoods; urbanisation and waste management; environmental degradation and contamination;
- to consider integrating mercury management within the broader context of the sound management of chemicals and wastes;
- to consider mainstreaming sound management of chemicals and wastes into national development policies and initiatives in order to address sustainable development targets.

3) ***Development, amendment and enactment of legislation*** to address the Minamata Convention and the obligations set out in its articles:
   - to prohibit mercury mining in accordance with article 3 - principally within in the Mining and Processing of Coal, Ores and Industrial Minerals Regulations, 2009. S.I. No. 31;
   - to prohibit or restrict the production, trade, use and disposal of mercury-added products in accordance with articles 4 and 6 - principally within the NAFDAC Act 15 of 1993-Cap NI LFN 2004, the NESREA ACT No. 25 of 2007 and the SON Act No. 18 (1990);
   - to prohibit manufacturing processes in which mercury mercury compounds are used in accordance with article 5 - principally within the NESREA ACT No. 25 of 2007;
   - to control emissions and releases of mercury and mercury compounds in accordance with article 8 - principally within the NESREA ACT No. 25 of 2007; the Environmental Impact Assessment (EIA) ACT. CAP E12,LFN 2004; the Harmful Waste (Special Criminal Provisions) Act Cap HI LFN 20; the NIMASA ACT (2007); and the NPA ACT Decree No. 38 (1999) LFN
   - to ensure that mercury wastes are managed in an environmentally sound manner in accordance with article 11 - principally within the Harmful waste (special criminal provisions) ACT. CAP H1,LFN 2004;
   - to revise these and other existing legal texts to remove inconsistencies or overlapping mandates and responsibilities amongst regulatory authorities to remove confusion that results in ineffective implementation;
   - to domesticate other chemical related MEAs whose provisions complement the implementation of the Minamata Convention, including the Basel Convention on the control of transboundary movement of hazardous wastes and their disposal, and the Stockholm Convention on persistent organic pollutants;
   - to revise Act No 15 of 2007, relating to the domestication of the Rotterdam Convention, to ensure that it is properly enacted and gives authority to the Federal Ministry of Environment for its implementation;
   - to formalize the NCCM clarifying its mandate and responsibilities to coordinate amongst chemical management stakeholders.
   - to assist states to develop compatible regulations and administrative rules to implement the Minamata Convention at state and local levels;

4) ***Assignment of administrative responsibilities***;

The FMEnv has been recognised as the official national contact and focal point for the convention in Nigeria. The identification of a focal point and national secretariat for the Minamata Convention in Nigeria is underway.

Many of the regulatory actions necessary to implement the Minamata Convention in Nigeria fall within the NESREA ACT No. 25 of 2007 and are thus within the responsibility of NESREA.

NESREA will also coordinate with other enforcement agencies, including for example NAFDAC, SON, CPC, Customs; and to enforce applicable laws and regulations thereby curtailing illegal trafficking of mercury and mercury-containing products;

The FMENv will be responsible for the following:
- to develop a national policy and implementation plans in consultation with stakeholders;
- to ensure continuing and effective coordination, engagement and information sharing between stakeholders including through the improved functioning of the NCCM and its TCC;
- to coordinate with national agencies to mainstream sound management of mercury into national development planning to meet the Sustainable development goals
- to develop methodologies and guidelines on mercury management to meet Nigeria's obligations under the convention;
- to prepare reports on the progress and effectiveness of the measures taken in Nigeria to implement the provisions of the convention for submission to the Conference of the Parties;

- to develop and implement, in collaboration with other key stakeholders, detailed action plans to implement the Convention in Nigeria;
- to develop and implement, within such action plans, campaigns to raise the awareness of stakeholders and the public of risks arising from the poor management of chemicals;
- to promote and require the use of viable and cost effective alternatives to mercury-containing products;
- to build the capacity of officers in mercury and broader chemicals management issues;
- to strengthen analytical capacity at existing laboratories, promoting their participation in international partnerships and networks to develop technical capacity and undertake national and global monitoring ;
- to strengthen links with development partners, including the UN agencies, for the provision of technical and financial support for the implementation of the convention.

Other federal ministries, departments and agencies will have responsibilities for particular aspects of the Minamata Convention. In particular,

- MMSD regulates mining and mineral processing and will have responsibilities in relation to Article 3: Mercury Supply; Article 7: ASGM; Article 8: Emissions; and Article 9: Releases;
- FMOH is responsible for public health and health systems and will have responsibilities with regard to procurement, use and disposal of medical devices and dental amalgam in the context of Article 4: Mercury-added products, Article 11: Mercury wastes.
- FMITI is responsible for industrial development and will have responsibilities with regard to Article 5: Manufacturing processes, in which mercury or mercury compounds are used.
- NCS controls the imports and exports of all goods including chemicals under applicable national and international regulations and so will have responsibilities with respect to Article 4: Mercury-added products and Article 11: Mercury wastes. The Service may need to determine whether current practices in HS and ASYCUDA coding are sufficient to discriminate mercury-added products or mercury wastes being transported across Nigeria's international boundaries and to make recommendations.

It is likely that responsibilities of other federal ministries, departments and agencies will be identified and recognised as work proceeds.

5) ***Establishment of sustainable systems for continuing and comprehensive inventory and reporting***

Parties to the Convention require a sustainable and comprehensive system for gathering and interpreting data on mercury use, trade, emission, release and disposal. The availability and regular production of information from such a system will be instrumental in focusing implementation, in evaluating the effectiveness of work undertaken, and in reporting to national stakeholders, Government and to the Conference of the Parties.

Data for such a system is likely to be gathered from a wide range of stakeholders including a number of ministries, departments and agencies. While FMEnv will act as focal point for the Convention, and so have responsibilities for reporting for the Conference of the Parties, responsibilities for the statistic system behind such reporting will need to be assigned in consultation with other key stakeholders including NBS.

Within this context, consideration will be given:

- to the development of a pollutant release and transfer register for the collection and dissemination of information on estimates of quantities of chemicals, including mercury, and other pollutants, that are emitted, released or disposed of through human activities
- to the development of geographic information systems for the identification and location of sources of emissions and releases, and of sites potentially contaminated by mercury.

Priority 2: Measures To Phase Down the Use of Dental Amalgam

Dental amalgam is likely to remain an important restorative material for use in Nigeria for the foreseeable future. It follows that a plan compatible with Article 4 and Annex A Part II of the treaty will be required to reduce dental amalgam use, to reduce the exposure of patients and dental health care personnel to mercury during dental treatment, and to avoid releases of dental amalgam from dental clinics.

Objective: Reduced use of dental amalgam

Outputs:

1. improved dental health
2. continued growth in the use of alternative dental restorative materials
3. amalgam use discontinued for vulnerable patients
4. dental professionals trained to prefer alternatives to amalgam
5. reduced releases of amalgam wastes from dental clinics

Activities:

The FMEnv and FMOH will continue to recommend strict adherence to the Best Management Practices (BMP) of amalgam waste handling and disposal practices during any amalgam phase-down process. Such a phase-down will be based on the provisions set out in Part II of Annex A of the Convention and include:

- setting national guidelines aiming at dental caries prevention and health promotion, thereby minimizing the need for dental restoration;
- setting national guidelines aiming at minimizing the use of dental amalgam, particularly in the care of children's primary teeth and of pregnant women;
- restricting the use of dental amalgam to its encapsulated form;
- promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration taking into consideration national circumstances;
- assessing, by FMOH, cost effective, durable and readily available alternatives to amalgam and including them in the list of free treatments available under the National Health Insurance Scheme and at national primary health centres while discouraging insurance policies and programmes that favour dental amalgam use over mercury-free dental restoration;
- encouraging professional organisations and dental schools to educate and train dental professionals and students in the use of mercury-free dental restoration techniques and materials;
- promoting best management practices at dental clinics in the use of dental amalgam and in the disposal of amalgam wastes;
- establishing an environmentally sound system for the collection, storage and disposal of amalgam wastes;
- increasing awareness of the health impacts of mercury in dental amalgam and promotion of the use of cost effective and durable mercury free alternatives;
- monitoring the progress of the phase down and evaluation of effectiveness and challenges;
- promoting research and development into best approaches for the introduction of mercury-free materials for dental restoration and the continued phase down of amalgam use in Nigeria.

Priority 3: ASGM National Action Plan

Objective: Reduced use of mercury amalgamation in ASGM

Outputs:

1. Worst practices of mercury amalgamation eliminated;
2. Miners trained in and using alternative processing techniques that minimise or eliminate mercury emissions and releases;
3. Vulnerable populations protected from mercury exposure;
4. Mercury emissions and releases to the environment minimised or eliminated

Activities:

ASGM in Nigeria demonstrates many of the characteristics that typify ASGM worldwide. The use of mercury amalgamation is widespread amongst mining communities that are informal, poorly skilled and economic vulnerable. In addition, gold ores contained by other heavy metals, particularly lead, worked by ASGM in Nigeria have created disastrous health impacts.

Nigeria 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 organisations and the communities will need to be involved in its preparation.

Such an action plan might consider inter alia, the need to:

- Create strong incentives for formalization of the ASGM activity to enhance the security of tenure of resources against enhanced responsibilities (including, for examples, government purchasing of ASGM gold at prices slightly above market prices, tax exemptions for ASGM miners, free and easily obtainable mining licences requiring retort use, etc);
- Establish responsibilities and promote coordination amongst relevant regulatory agencies at national, state and local levels to implement the action plan;
- Develop baseline estimates of mercury used and the techniques employed;
- Promote increased awareness of the health impacts of continued poorly-controlled ore processing, including mercury amalgamation ;
- Prohibit whole ore amalgamation, open burning or amalgam - in particular within residential areas, and cyanide leaching of mined materials to which mercury has been added but not removed;
- Promote, as an initial step, low-cost and low-tech mercury capture techniques that allow miners to meet emission standards by re-using mercury and preventing releases;
- Promote alternative gold processing techniques not requiring the use of mercury;
- Strengthen national monitoring and enforcement programmes to ensure that up to date emission controls are in place and in use;
- Develop national safety guidelines to protect the populace from the cumulative long-term health impacts of mercury exposure.

Priority 4: Reducing Emissions from Coal-Fired Power Plants and Industrial Boilers

Article 8 and Annex D of the convention recognise the important role that certain point source categories can play in emitting mercury. The inventory has identified the importance of some of these sources in Nigeria.

Objective: Reduce emissions of mercury from point source categories

Outputs:

1. Emissions from coal-fired power plants and industrial boilers minimised;
2. Investment in new facilities incorporates BAT/BEP to minimise emissions

Activities:

The major expansion of coal-fired energy generation planned in Nigeria and the expanding use of coal in industrial boilers, will need to be considered in plans to meet Nigeria's obligations under the Minamata Convention. As a future Party to the Convention, Nigeria would need to consider the provisions of Article 8: Emissions.

Within this context, actions that might be required could include:

- proposals by relevant government regulatory agencies for emissions standards to limit mercury and other toxic pollution from coal-fired power plants and industrial boilers;
- reviewing of EIA guidelines for power plants and industrial boilers to include mercury abatement techniques;
- determination of techniques and practices constituting BAT/BEP to be applied at new sources;
- retrofitting significant existing point sources lacking pollution abatement technologies with BAT/BEP;
- strengthening national monitoring and enforcement programmes to ensure that up to date emission controls are in place.
- developing national safety guidelines to protect the populace from the cumulative long-term health impacts of low-level mercury exposure.

Priority 5: Reducing Emissions from Cement Clinker Production Facilities

No information has been gathered during this assessment on either the actual mercury content of the raw materials used in cement production in Nigeria or the mercury content of emissions and releases from cement plants. Given the highly variable nature of mercury content in the raw materials used in cement production, a first priority is for a programme of testing of these materials. The results of such a programme would confirm the need for action in the cement industry in accordance with Article 8 of the Convention or, potentially, eliminate this sector as a significant source of emissions and releases in Nigeria.

Where action is found to be required, efforts to reduce mercury emissions could take advantage of continuing investment by the private sector in new

plant and facilities. In this regard, there would need to be consideration of national guidelines on mercury abatement taking in account techniques and practices considered to represent BAT/BEP.

Priority 6: Mercury Wastes

Waste management practices in Nigeria represent an important source of mercury emissions, releases and site contamination.

The development of actions to reduce these impacts will need to be taken up in coordination with key stakeholders across federal, state and local government within the broader context of improving waste disposal practices and services in Nigeria.

Particular *activities* will likely include:

1. separation mercury-containing products from municipal waste streams

2. separation of discarded medical devices containing mercury from clinical wastes

3. application to e-waste practices of techniques that minimise or prevent mercury emission and release

4. development of environmentally sound interim storage for mercury waste prior to disposal under the terms of the Basel Convention.

Priority 7: Strengthening and Upgrading of Relevant Laboratories for Specialized Chemical Analysis that Will Include Mercury

Activities

- Inventory of existing laboratories with capacity to analyse mercury.
- Selection of laboratories across the six geopolitical zones for upgrading.
- Upgrading of selected laboratories to meet international best practices to analyze mercury emission and releases.
- Training of analytical professionals on the use of the upgraded equipment for analyzing mercury and its compounds.
- Certification of the upgraded laboratories by International Organization for Standardization (ISO).

Other Priorities

As work to implement the Minamata Convention progresses and as further information about mercury issues in Nigeria is accumulated, there will be a need to review and, if necessary, modify the actions proposed above. There might also be a need to generate additional action plans. For example:

- proposals to re-establish smelting and roasting operations for non-ferrous metals would require actions in relation to Article 8: Emissions.
- potential releases of mercury to land and water from bauxite mining and aluminium production; from oil and gas exploration, extraction and processing; and perhaps from the pulp and paper industry might require actions in relation to Article 9: Releases

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