



The State of Eritrea  
Ministry of Land, Water and Environment



**MIA 2020**

Minamata Convention on  
Mercury Initial Assessment



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# Foreword

*Mercury, the only metal in liquid state at normal temperature, occurs free in a limited amount in nature. It is used in the manufacture of a variety of widely used products such as thermometers, barometers, fluorescent lamps, consumer batteries, insecticides, amalgams used to fill dental cavity, paints. Mercury is also applied in industrial catalysis and processes of gold recovery from its cores.*

*Because it is highly toxic with great ability to be transported, mercury and mercury containing products could trigger a number of irreversible damages to human health and the environment. Disruption of the nervous system, damage to brain function, DNA damage and chromosomal damage, allergic reaction and negative reproductive effects are some of the well documented impacts of mercury on human health. Recognising the grave threat that mishandling of mercury pose to human health and the environment, the international community endorsed the Minamata Convention on Mercury, the objectives of which is to secure global cooperation in controlling mercury pollution and its impacts on human health.*

*Eritrea has yet not acceded to the Convention, but it controls the import and use of mercury in the country. Nevertheless, mercury application in illegal artisanal gold mining by people who have no knowledge about its health and environmental hazards is worrisome. Breakdown of mercury containing minerals and soil through exposure to erosion agents, as well as release of mercury into the air from fossil fuel combustion in the transport and power sectors, open air solid waste combustion, application of insecticides and artificial fertilizers, disposal of mercury containing products and wastewater from mines are major sources of mercury pollution that require special attention in our country.*

*As the issue leaves no room for complaisance, the Ministry of Land, Water and Environment initiated a survey study to prepare National Minamata Initial Assessment (N-MIA) report by assessing the different sources of mercury and estimating the levels of its releases and emission into the environment. Furthermore, a National Action Plan (NAP) has been prepared specifically to indicate future road of eliminating mercury use in artisanal gold mining activities. Both documents contain comprehensive information on mercury and mercury containing products management infrastructures, including institutional, legal, administrative and technical aspects along with the nature of import, use, storage and disposal in the country. Likewise, appropriate consideration was given to the synergic advantage to be accrued from the implementation of the multilateral environmental agreements related to mercury management vis-a-vis the Stockholm, Rotterdam and Basel Conventions.*

*In conclusion, while I confirm Eritrea's commitment to contribute its part towards the achievement of global goals in addressing the challenges of mercury related pollution, I would like to express my sincere appreciation to all the stakeholders, including policy makers, government agencies, nongovernmental organisations and the general public as well as the international partners who made contribution in producing both the N-MIA and NAP documents; and I call for their further committed cooperation in implementing the action plans proposed in both documents.*

Tesfai G. Selassie Sebhata  
Minister of Land, Water and Environment  
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Kibrom Asmerom,

Acting Director General,  
Department of Environment,



# List of ACRONYMS and UNITS

Symbol	Meaning
%	Percentage
*	Multiplied by
/	Divided by
<	Inferior to
>	Superior to
°C	Celsius degree (centigrade)
µg	Micrograms
ASGM	Artisanal and Small-scale Gold Minding
BLO	Business Licensing Office
BMSC	Bisha Mining Share Company
DoC	Department of Customs
DoE	Department of Environment
DoI	Department of Industry
DoM	Department of Mines
DoMT	Department of Maritime Transport
DoW	Department of Water
EIA	Environmental Impact Assessment
ENAMCO	Eritrean
EPA	Environment Protection Agency
ESI	Eritrean Standards Institute
ESP	Electrostatic Simple Precipitator
ESTDA	Eritrean Science and Technology Development Agency
GHGs	Green House Gases
HWOW	Hazardous Waste and Other Wastes
ICAM	Integrated Coastal Area Management
ICP	Inductively Coupled Plasma
IPM	Integrated Pest Management
Kg	Kilogram
KWh	Kilowatt k hour / Unit of energy
MDGs	Millennium Development Goals
MIA	Minamata Initial Assessment
MoA	Ministry of Agriculture
MoE	Ministry of Education
MoEM	Ministry of Energy and Mines
MoI	Ministry of Information
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoH	Ministry of Health
MoJ	Ministry of Justice
MoLG	Ministry of Local Government
MoLWE	Ministry of Land, Water and Environment
MoMR	Ministry of Marine Resources
MoTC	Ministry of Transport and Communication
MoPW	Ministry of Public Works
MRED	Maekel Region Environment Division
MW	Mega Watt
NAPA	National Adaptation Program of Action
NAPHL	National Animal and Plant Health Laboratory, Ministry of Agriculture
NEC	National Environmental Council
NEAPG	National Environmental Assessment Procedures and Guidelines
NEPFAP	National Economic Policy Framework and Program

NSO	<i>National Statistics Office</i>
NUEW	<i>National Union of Eritrean Women</i>
NUEYS	<i>National Union of Eritrean Youth and Students</i>
ODS	<i>Vienna Convention and the Montreal Protocol on Ozone Depleting Substance</i>
PCDD	<i>PolyChlorinated Dibenzo p-Dioxins</i>
PCDF	<i>PolyChlorinated DibenzoFurane</i>
POPs	<i>Stockholm Convention on Persistent Organic Pollutants</i>
PPE	<i>Personal Protective Equipment</i>
Ppm	<i>Part per million</i>
PU/PUR	<i>Polyurethane</i>
PVC	<i>Polychlorite Polyvinyl Chloride</i>
SPCG	<i>Strategic Partnership Cooperation Framework</i>
T	<i>Ton 100 kg</i>
TMF	<i>Tailing Management Facility</i>
UN	<i>United Nations</i>
UNDP	<i>United Nations Development Programme</i>
UNEP	<i>United Nations Environment Programme</i>
UNITAR	<i>United Nations Institute for Training and Research</i>
UNSD	<i>Statistics Division of the United Nations</i>
USA	<i>The United States of America</i>
UV	<i>Ultraviolet</i>
VCM	<i>Vinyl Chloride Monomer</i>
VMS	<i>Volcanogenic Massive Sulphide</i>
WHO	<i>World Health Organization</i>
XRF	<i>X-Ray Fluorescence</i>
ZMSC	<i>Zara Mining Share Company</i>



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# Executive Summary

The Minamata Convention on mercury was adopted and entered into force in October 2017 to address the challenges posed by mercury threats on a global scale. The main objectives of the Minamata Convention are to protect human health and the environment from mercury toxicity resulting from human activities. The Convention aims to promote the use of alternatives, 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 of mercury and mercury-added products.

Although Eritrea does not produce mercury and imports negligible amounts of mercury-added products, the country has taken measures in relation to mercury based on the existing sources of information, national legislation, inventory and artisanal and small-scale gold mining (ASGM) practices with regard to the initial assessment of mercury. As can be inferred in this document, the illegal import is one of the main sources of the mercury used in ASGM.

Mercury is a highly toxic heavy metal which poses a global threat to human health and the environment, even in very small amounts. Article 4 clearly noted that each party, by taking appropriate measures, shall not allow the manufacture, import or export of mercury-added products listed in part 1 of

Annex A after the phase-out date specified for these products, while Articles 8 and 9 call on each party to reduce the emission and release of mercury and mercury compounds to the atmosphere, land and water from the relevant point source not addressed in other provisions of the convention. Article 7, paragraph 1 of the Convention recognizes ASGM, as the largest source of anthropogenic mercury emissions. Article 11 which is relevant to the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal shall apply to wastes covered under this convention for parties to the Basel convention and in Article 12 each party endeavours to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds.

Eritrea is found in the horn of Africa and has a population of 3.2 million. The country consists of nine ethnic groups speaking nine different languages and is divided into six administration regions. Eritrea has fought thirty years of bloody war for independence against the occupation by Ethiopia and gained its independence in 1991. The war left Eritrea with ruined infrastructure and a devastated economy. The government, right after independence, put in place a transitional economic rehabilitation and reconstruction programme to be implemented in phases and the economy showed appreciable improvement, until Ethiopia declared another war of aggression against Eritrea in 1998. Although the economic impact of the renewed

war was enormous, the government has made remarkable achievement in the revitalization of the economy during the no-war, no-peace situation. Agriculture, fishery, mining and tourism are among sectors on which the Eritrean economy depends greatly whereby the agricultural sector contributes the largest share. Eritrea is endowed with various mineral resources including gold, silver, copper, zinc, potash etc.

By virtue of its geographic location and economic development, the country faces various environmental challenges including, climate change induced deforestation, land degradation, biodiversity loss as well as environmental pollution from the mismanagement of wastes and chemicals.

In view of these environmental challenges, the country has formulated policies and promulgated several regulatory and legal frameworks e.g. Proclamation No. 179/2017 and its Legal Notice No.127/2017, Legal Notice No.19/1995 of the MOEM, NEAPG, National healthcare policy. Several action plans including national adaptation plan of action on climate change, action plan for combating desertification, national biodiversity strategy and action plan, the national environmental management plan, the second national communication on climate change, the health sector strategic development plan and Healthcare waste management plan have been also developed and implemented. Moreover, Eritrea is a signatory to various international conventions that contribute to the sound management of chemicals and wastes and reduction of environmental pollutions. These conventions include the Rotterdam convention on prior informed consent, Basel Convention on transboundary movement of hazardous wastes, Stockholm convention on the persistent organic pollutants, and the Montreal protocol on substance that deplete the ozone layer.

Wider assessments and consultations were conducted on stakeholders whose activities are considered as sources of mercury emission/release and the analysis on the level of emission was evaluated using the Toolkit Level 1 and Level 2 that work with pre-determined emission factors. The inventory team preferred using the Toolkit Level 2 to calculate the mercury emission and releases in the country and used partially country-specific input and output factors.

The releases and emissions to air, water, and land is evaluated and expressed in kilograms (kgs) of mercury released or emitted per annum (kg Hg/y). Major mercury source categories were identified in the country, through the Level 2 inventory, that include energy consumption, primary metal production, gold extraction with and without mercury amalgamation, use and disposal of mercury added products and wastes, the total annual mercury emission from these sources is estimated to be 5816 kg Hg/year, using Toolkit Level 2, and the largest contribu-

tion (87%) comes from gold extraction with and without mercury amalgamation, alongside the use of consumer products with intentional mercury use.

Another major component addressed in the report is the effort made to identify the suspected contaminated sites, in accordance to Article 12 of the Minamata Convention. The strategy for identifying and assessing mercury-contaminated sites for the country has been developed.

The assessment on contaminated sites covers the majority of the abandoned artisanal mining sites that were active during the Italian colonial era. Most of these old sites are to be found scattered in the Gash Barka administration region, congested in the regional administration of Maekel where the population around these suspected contaminated sites is high. A few suspected contaminated sites have been also identified in Debub, Anseba and Northern Red Sea regional administration. A preliminary investigation on some of the abandoned artisanal mining sites revealed that mercury use was evident and soil contamination is likely high. It is recommended to conduct in-depth investigation over the aforementioned sites to make final conclusive decisions.

The waste dump sites are also considered as part of the suspected mercury contaminated sites. So, the Asmara dumping sites have been preliminarily investigated. In general, waste dump sites of cities and towns need in-depth investigation.

Assessment of the legal frameworks and institutional capacity was carried out on fifteen sectoral policies, regulations and laws and reviewed to evaluate the existence of any provisions pertinent to sound management of mercury as set in the Minamata Convention of mercury. The review of the policy and mandate of the institutions under consideration (see annex I – list of reviewed institutions) reveals that despite the fact that these institutions do not have a policy, they rather have mandates that are crucial for the implementation of mercury management. However, very few have a policy in their designated sector to address mercury use. Thus, pursuant to Legal Notice No.19/1995, of Department of Mines of the Ministry of Energy and Mines (hereafter, DoM), any artisanal mining activities with application of mercury amalgamation as well as any artisanal mining activities (regardless whether mercury is used or not) deeper than 5 meters is totally prohibited and any artisanal mining activity that does not comply with the provisions is considered illegal.

Generally, the assessment revealed that Eritrea has relatively strong legal and institutional systems for sound management and protection of environment. However, as regards to the specific management and use of mercury or mercury compounds, Eritrea needs to revise, update and adopt laws, regulations and directives. Apart from the prohibition of the use of mercury in the mining sector, there is no specific legal regime that governs other uses of mercury and management of mercury waste.

Moreover, the roles of government ministries and other institutions such as Customs Office (CO), Eritrea Stand-

ards Institute (ESI), Eritrean police, National Union of Eritrea Women (NUEW) and National Union of Eritrean Youth and Students (NUEYS) have been assessed and recommendations set forward.

With the objective of addressing existing gaps and challenges for the sound management of mercury, five major priority areas and intervention plans along with their detailed proposed activities and relevant descriptions of required skill and knowledge to undertake, the relevant stakeholders which have to take lead and cooperative roles, the implementation schedule and the required budget as well as potential funding source are indicated. The proposed priority action areas and intervention plans are:

- Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level
- Phasing-out and phasing-down of the import of mercury-added products
- Putting in place an environmentally sound management system for waste management, including mercury-containing waste
- Reducing the emissions of mercury and mercury compounds from cement clinker production
- Safeguarding sites/ areas suspected of being contaminated with mercury
- Mainstreaming of mercury priorities into existing national plans and/or programmes

The proposed budget to undertake the aforementioned priority areas and intervention plans is estimated to be USD 4,700,000. Funding would be sought from international partners such as GEF and other multilateral partners with about 10% contribution in kind from the government of the state of Eritrea



## 1. Mercury as an Issue

Mercury is a chemical element with the symbol Hg and atomic number 80. It is a dense, silver-white metal that is liquid at ordinary temperatures. It may occur in native form in nature but is more commonly found in the form of a mineral called cinnabar, mercury sulphide (HgS). It may also occur with other non-ferrous sulphide minerals (zinc, lead, arsenic, gold) 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 under changing atmospheric pressure. These unique properties have made it useful in devices, designed to measure temperature and pressure.

Mercury is a persistent element in the environment. It is naturally released into the air as vapour during processes such as volcanic activity, rock weathering, water body movement, forest fires, biological processes, etc. While natural releases continue, they do not account for the considerable increase in environmental mercury levels since the on-set of the industrial age. So, it is clear that significant amount of 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 emissions, 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. (UNEP, 2013a).

Anthropogenic activities contributing to mercury releases include the processing of some base metals, the burning of coals and hydrocarbon fuels, the open use of mercury in industrial processes and in ASGM, and the breakage and improper disposal of mercury-containing products.

Once in the atmosphere, mercury may circulate globally before being deposited 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 deposition.

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, and mercuric sulphide.). In addition, it may be subject to biotransformation by aquatic microorganisms into the organic forms such as methyl mercury and ethyl mercury.

Mercury is present in various environmental media and

food (especially in fish and seafood) all over the globe. Mercury bio accumulates in the food chain and this can result in concentrations in food resources at levels that adversely affect humans and wildlife. While harmful methyl-mercury concentration in fish are well established. Studies of accumulated mercury in some types of wild mushrooms and innards<sup>1</sup>, therefore, show that one has to be careful when consuming these food stuff. Fishery products contaminated with Hg could be included too as bioaccumulation is much greater in marine organisms. Furthermore, exposure to mercury may be magnified where current or past economic activities have resulted in landfills, mine tailings, factory sites, soils and sediments contaminated with mercury.

Mercury is considered by the World Health Organization (WHO) as one of the top ten chemicals or groups of chemicals of major public health concern. Elemental and methylmercury are toxic to the central and peripheral nervous systems. According to the WHO (2017), “The inhalation of mercury vapour can have harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested”<sup>2</sup>. Moreover, after exposure to mercury, neurological and behavioural disorders can occur, including tremors, insomnia, memory loss, neuromuscular effects, headaches and cognitive and motor nerve malfunction, as well as kidney failure.

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. According to Boening (2000), a wide variety of birds that fed on inorganic mercury shows a reduction in food intake and consequent poor growth. Moreover, other effects in avian receptors have been reported, i.e. increased enzyme production, decreased cardiovascular function, blood parameter changes, immune response, kidney function and structure, and behavioural changes<sup>3</sup>.

## 2. The Minamata Convention on Mercury

In 2001, the United Nations Environment Programme (UNEP) conducted a global assessment on mercury and its compounds, which included several aspects, such as health and environmental impacts, mercury sources, long-range transportation and prevention and control technologies relating to mercury. This assessment provided sufficient evidence of global adverse impacts caused by mercury and its compounds and the need for global action to reduce the use of this metal and diminish the risks to human health and environment. Governments were encouraged to adopt national initiatives and goals to use environmentally sound methods to manage the use of mercury and mercury compounds towards its reduction

1- Journal of Food Composition and Analysis, Volume 82, September 2019, 103239

2- <http://www.who.int/news-room/fact-sheets/detail/mercury-and-health>

3- <https://www.ncbi.nlm.nih.gov/pubmed/10789973>



or elimination.

In 2009, the Governing Council of UNEP agreed that voluntary actions had not been sufficient to address the concerns relating to mercury and agreed on the need for further action, including the preparation of a global, legally binding instrument. An Intergovernmental Negotiation Committee (INC) was established to prepare the treaty and began its work in 2010. The INC concluded its fifth session in Geneva, Switzerland in January 2013 by agreeing the text of the Minamata Convention. The Convention was adopted and opened for countries signature later that year at a Diplomatic Conference (Conference of Plenipotentiaries), held in Kumamoto, Japan (7-11 October 2013).

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The Convention draws attention to a global and ubiquitous metal that, while naturally occurring, has broad uses in everyday objects and is released to the atmosphere, soil and water from a variety of sources. Controlling the anthropogenic releases of mercury throughout its lifecycle has been a key factor in shaping the obligations under the Convention. It promotes the use of alternatives, best available techniques and best environmental practices across a wide range of products, processes and industries where mercury is used, released or emitted, and provides measures for the control and phasing out/phasing down of mercury and mercury-added products (UNEP, 2013b). The Minamata Convention entered into force on 16 August 2017, and the first Conference of the Parties was held in the last week of September 2017.

### **3. Summary of Key Provisions of the Minamata Convention**

Major highlights of the Minamata Convention include a ban on new mercury mines, the phasing-out of existing ones, the phasing-out and phasing-down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation on the informal sector of ASGM. The Convention also addresses interim storage of mercury and mercury-added products and their disposal once they become waste.

### **4. The Minamata Initial Assessment (MIA)**

The Global Environment Facility (GEF) has allocated funding to strengthen national decision making towards ratification of the Convention and to support its implementation, including the development of national Minamata Initial Assessments (MIAs). The MIAs assess existing national sources and uses of mercury, strengthen national decision-making towards ratification of the Convention and build national awareness and capacity towards implementation of future obligations.

The overall objective of the MIA is to assist the countries to prepare for the implementation of the Minamata Convention, and provide information for strategic deci-

sion-making, and to prioritize areas for future interventions.

### **5. MIA Project in Eritrea**

Eritrea has undertaken meaningful steps to understand the human health and environmental concerns of mercury and towards ratification of the Minamata Convention which aims to protect human health and the environment from mercury contamination. The MIA project in Eritrea aims to assess the existing sources of information, legal infrastructure and institutional capacity of mercury management, developing an inventory and an overview of different sectors pertaining to mercury. Although Eritrea, neither produces nor exports mercury, it does import negligible amounts of mercury-added products. The country has taken significant measures to assess mercury contamination so as to curb the problem that could result from the use of mercury and its compounds. To enhance and refine such measures of assessments of mercury contamination, the country needs to have appropriate technologies.

# 1. General Information

## 1.1 Country Background

### 1.1.1 Geography

Eritrea is a north eastern African country located between latitudes 12022' and 18002'N, and longitudes 36026' and 43013'E<sup>4</sup>. The country is bordered by the Sudan to the north (Ras Kasar) and west, Ethiopia to the south, Djibouti to the south-east (Dar Elwa) and the Red Sea to the east and north-east. It has a mainland coastal line of about 1350 kilometres long at the western coast of the Red Sea and another 1950 kilometres of coast line around its 356 islands<sup>5</sup>. Its territorial waters cover about 120,000 square km<sup>6</sup>. The widest part of the Eritrean Red Sea is around the Dahlak Archipelago and the narrowest is across the southern coast in the vicinity of Bab-el-Mandeb. With more than 1,000 species of fish, the Eritrean Exclusive Economic Zone (EEZ) is known for its high fish productivity and diversity<sup>7</sup>. The surface area is approximately 125,000 km<sup>2</sup>, including the fossilized corraling islands. The country is home to nine ethnic groups that live with a sense of harmony<sup>8</sup>. Figure 1.1 shows the map of Eritrea.



Figure 1.1: Geographic Location of Eritrea

### 1.1.2 Population

According to the Eritrea Population and Health Survey (EPHS, 2010), the census to establish the population size has not yet been updated. However, the population estimate made in 2010 by the Ministry of Local Government revealed that the population size of Eritrea is about 3.2 million with an annual growth rate close to 2.91%. The population of Eritrea is not uniformly distributed throughout the country. The age distribution is that of a high fertility regime in which a larger proportion of the population is to be found in the younger age groups. It is also marked by migration due to prolonged wars. In general, the central highlands are the most densely populated part of the country, while the Lowlands are sparsely populated. About 50–60% of the population live in highlands

4-National Statistics Office [Eritrea]. 2013. Eritrea Population and Health survey 2010. Asmara, Eritrea, National Statistics Office.

5- State of the coast 2006-2007; Ministry of Fisheries, 2007.

6- Eritrea, Ministry of Land, Water and Environment, 6th National Report to the Convention on Biological Diversity, 2019.

7- Indicative Development plan, Ministry National Development, 2009

8- Eritrea. 2010. Eritrea Mining Journal.

9- <https://commons.wikimedia.org/wiki/File:Un-eritrea.png>.

10-National Statistics Office [Eritrea]. 2013. Eritrea Population and Health survey 2010. Asmara, Eritrea, National Statistics Office.

11-Rebecca Klaus. 2015. Coral Reefs and communities of the central and southern Red Sea (Sudan, Eritrea, Djibouti, and Yemane).

12-Ministry of Land, Water and Environment [Eritrea]. 2018. Enabling Activities to Review and Update the National Implementation 13-Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs) Project. Asmara, Eritrea: Ministry of Land, Water and Environment. National Statistics Office [Eritrea]. 2013. Eritrea Population and Health survey 2010. Ministry of Land, Water and Environment. Revised national biodiversity strategy and action plan for Eritrea 2015.

15- National Implementation Plan on POPs in Eritrea (2012).

that comprise only about 10% of the country's total land area. About 65% of the population live in rural areas<sup>10</sup>.

### 1.1.3 Culture and Language

Eritrea has a multi-ethnic society with nine different ethnic groups speaking nine different languages (Arabic, Kunama, Bilen, Nara, Bedawyet, Tigre, Saho, Afar and Tigrigna)<sup>11</sup>. Eritrea's population adheres mainly to two religions, namely Christianity and Islam. In addition to the languages spoken by the various ethnic groups, Arabic and English are widely understood, where English, as a foreign language, is commonly used as a medium of instruction in academic institutions and international relations<sup>12</sup>.

## 1.2 Government

Eritrea is divided into six zobas (regions) namely Maekel, Debub, Anseba, Gash-Barka, Semenawi Keih Bahri and Debubawi Keih Bahri, as represented in the Figure 1.2<sup>13</sup>. The form of governance and administration of the different zobas is decentralised aiming to support rural development. The mandate and responsibilities of the various levels of administration are set out in the Proclamation for the Establishment of Regional Administration (PERA) No. 86/1996<sup>14</sup>.

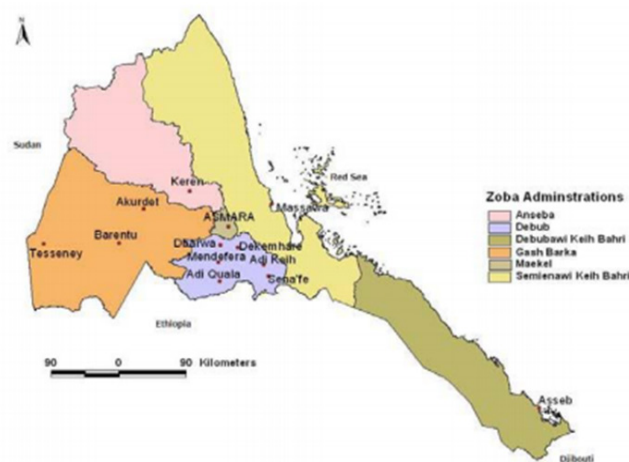


Figure 1.2: Administrative Map of Eritrea<sup>15</sup>

## 1.3 Economy and Socio-Economy

The war for independence resulted in huge human as well as material loss. As a result, in 1991, the transitional Government of Eritrea encountered a ruined infrastructure and devastated economy and environment. This compelled Eritrea to entirely reconstruct its social, economic, and physical infrastructure. The economy started showing an encouraging progress for seven years until May 1998. In an effort to place the economy on a path of sustainable development, the government targeted the period 1998-2000 to complete the transitional phase of rehabilitation and reconstruction. Unfortunately, in May 1998, Ethiopia declared war on Eritrea, under the pretext of a border dispute, and occupied some parts of Gash-Barka and Debub regions. The impact of the war of aggression on the econ-

omy of Eritrea resulted partially in the destruction of the infrastructure which had been painfully built in the initial seven years of peace and independence<sup>16</sup>.

The Government development efforts focused not only on rebuilding and rehabilitating the war damaged and destroyed economic and social infrastructures, but also on formulating numerous national economic and social development strategies and policies. That includes the Macro Policy of 1994, which mapped out short, medium, and long-term reconstruction and development programmes.

Eritrea's economy is mainly dependent on agriculture, fishery, mining and tourism. Agriculture and pastoralism are the main sources of livelihood for about 80% of Eritrea's population. The agricultural sector depends mainly on rain-fed agriculture, with less than 10% of the arable land currently irrigated. Consequently, productivity is low.

Industry accounts for about 22% of GDP. The balance of national income is accounted for by the service sector, which in 2002 was 58% of GDP<sup>17</sup>. Although there are no officially published figures, the mining sector is assumed to have contributed to the GDP with the start of gold, copper and zinc concentrates production at Bisha and gold mining at Zara. The sector's GDP contribution is expected to further grow in the future with the commencement of the Asmara Mining Sh.Co (gold and base metals 'Copper and Zinc concentrates') near Asmara (Maekel Region) and Colluli Mining Sh.Co (Potash) at Colluli, in Semienawi Keih Bahri of Eritrea.

Eritrea's long-term development objective is to attain rapid and widely shared economic growth with macroeconomic stability, and steady and sustainable poverty eradication. The objectives are to promote equitable economic growth and development including developing exports, increasing agricultural productivity, attracting investment in fisheries, tourism, construction, manufacturing, developing strong financial sector. It plans to expand and modernize the country's basic infrastructure<sup>18</sup>.

## 1.4 Natural Resources

The potential of different minerals and rocks such as gold, copper, zinc, potash, granite, marble, basalt and numerous other rocks and minerals have been identified, including feldspar, gypsum, asbestos, mica, and sulphur. Fishery from the Red Sea has also the potential in the future to constitute a significant percentage of the country's exports. Principal imports include food, various machineries, vehicles and chemical products<sup>19</sup>.

## 1.5 Environmental Overview

Eritrea is located within an environmentally risky region. As such, the country faces several natural environmental challenges such as droughts, floods, increased variability in rainfall patterns and/or reduced precipitation, soil

erosion, desertification and land degradation. Moreover, chemical pollution is a concern in Eritrea, notably with the use of pesticides, with the National Implementation Plan<sup>20</sup> under the Stockholm Convention identifying them as being widely used at the national level.

### 1.5.1 Environmental Concerns

#### A. Forestry

A century ago, the forest coverage in Eritrea was 30% of the total land area and the figure gradually declined sharply to less than 1%, according to an estimate made in 1995. The main factors that contribute negatively to its deterioration are land clearing for agriculture (deforestation), overgrazing, wood for fuel, construction of traditional houses, drought and war. Right after the independence, the Transitional Government of Eritrea started taking a lot of intervention measures to rehabilitate the forest coverage of the country at national level during the last over two decades. Although various studies on the topic and its sustainability had been conducted, the impact of the rehabilitation measures is not as yet comprehensively assessed nationally. Nonetheless, the greening effects are indeed visible in many parts of the country. As an adaptation strategy, the government has already taken concrete measures such as different afforestation programmes, soil and water conservation measures, rural electrification, and nationwide distribution of energy saving cooking stoves "Adhanet" for rural households (see section 2.5.3). Community members and social groups are heavily involved in the implementation process. Despite all the government's efforts, deforestation is still a concern and further concerted efforts are of importance to address the issue appropriately<sup>21</sup>.

#### B. Coastal Zone, Islands and Biodiversity

Due to its geo-morphological and environmental complexity, Eritrea has a multitude of habitats for plants and animals to occupy and this has led to its high biodiversity. The landscape with altitudinal gradient from 120 meters below sea level to over 3000 m and climatic variation from wet and humid to xeric and dry, Eritrea has several areas with unique ecosystems<sup>22</sup>. The island and coastal zones themselves are hot, dry, sparsely inhabited and have diverse ecosystems. The Government of Eritrea has prepared a National Biodiversity Strategy and Action Plan which contains appropriate strategies and actions related to coastal zone biodiversity with great conservation value and sustainable use<sup>23</sup>. The Ministry of Marine Resources along with its relevant stakeholders has developed an Integrated Coastal Area Management (ICAM). This may safeguard the marine, island and coastal zones from any developmental and pollution challenges that may result from within the coastal areas and/or within the watershed. Fisheries Proclamations administering the fishery sector and fishery product and potable water are also in place.

16- National Statistics Office [Eritrea]. 2013. Eritrea Population and Health survey 2010. Asmara, Eritrea, National Statistics Office.

17- Ministry of National Development

18- Rebecca Klaus. 2015. Coral Reefs and communities of the central and southern Red Sea (Sudan, Eritrea, Djibouti, and Yemane).

19- Ministry of Land, Water and Environment [Eritrea]. 2017. Ozone Depleting Substances Alternative Report Project. Asmara,

20- Eritrea: Ministry of Land, Water and Environment.

21- Nationally Determined Contributions (NDCs) Report Submitted to UNFCCC. Asmara, Eritrea.

22- Ghebrehwet Medhanie, Biodiversity of Qohaito and prospects for Ecotourism, International conference on Eritrean studies, Asmara, July, 2016.

23- Ministry of Land, Water and Environment. Revised national biodiversity strategy and action plan for Eritrea 2015.



## C. The Waste Sector

There are diverse types of wastes, among mercury-added products and others such as medical, infectious and non-infectious, pharmaceutical and special hazardous wastes. Wastes pollute the environment which in turn endanger the health conditions of the public, if not managed properly. In an effort to reduce the impacts of waste on human health and the environment, the Government of

the state of Eritrea continues to develop its national laws on the environment, particularly the regulations pertaining to the sound management of hazardous wastes<sup>24</sup>. Such national laws would include among others, standard and appropriate regulatory instruments, and awareness raising activities.

## D. Climate

The country exhibits a varied topography, rainfall and

Table 1.1: List of existing national regulatory regime

Sector	Existing National Regulatory Regime	Year	Present Status	
Environment	The Eritrean Environmental Protection, Management and Rehabilitation Framework Proclamation No. 179/2017	2017	Issued	
	Environmental Protection and Management Regulations- Legal Notice No. 127/2017	2017	Issued	
	Regulations for the Issuance of Permit for the Importation or exportation of Ozone Depleting Substances (ODS) and ODS Based Equipment or Products	2010	Issued	
	The ban on importation of thin plastic bags by a Legal Notice No. 99/2004	2004	Issued	
	National Environmental Assessment Procedures & Guidelines	1999	Adopted	
	Proclamation on Biological Diversity	1998	Drafted	
	National Environmental Management Plan for Eritrea (NEMP-E)	1997	Adopted	
	Eritrean National Code of Conduct for Environmental Security	1995	Adopted	
Agriculture	Pesticide legislation	2014	Drafted	
	Plant Quarantine Proclamation, No.156/2006	2006	Issued	
	Legal Notice N0 114/2006, Regulation for Importation, Handling, Use, Storage and Handling and Disposal of Pesticides	2006	Issued	
	Agricultural Sector Policy and Strategy Framework	2002	Adopted	
Marine Resources	Legal Notice No. 104/1998 and 176/2014 The Fisheries Proclamation which includes prohibition of discharge or deposit waste or any other polluting matter	1998 and amended in 2014	Issued	
	The Fishery Product Proclamation No 105/1998: • Legal Notice No. 40/1998 The Fishery Product Regulation • Legal Notice No. 41/1998 The Fishery Product Hazard Analysis Critical Control Points Regulation • Legal Notice No. 42/1998 The Potable Water Regulation • Legal Notice No. 64/2003 The Aquaculture Products Regulation • Legal Notice No. 65/2003 The Additives Regulations • Legal Notice No. 68/2003 Potable Water Regulations in Fishery Product Activities	1998 and 2003	Issued	
	Legal Notice No. 66/2003. The Heavy Metals Regulations:	2003	Issued	
	Coastal Policy	2006	Drafted	
	Eritrea Integrated Coastal Area Management (ICAM) Proclamation	2007	Drafted	
	Guidelines for indoor residual spraying	2017	Adopted	
	Training manual for indoor residual spraying	2017	Adopted	
Health	Insecticide Resistance Monitoring and Management plan	2015	Adopted	
	Policy and Guidelines for Malaria Control in Eritrea	2003	Adopted	
	Environmental Health Policy and Guidelines	1998	Adopted	
	National Health care waste management policy	2010		
	Trade and Industry	Eritrean Standard Institute Proclamation	1995	Issued
		Business Licensing Proclamation No. 72/1995	1995	Issued
Regulation to Declare Eritrean Standards Institute		1997/2000/2004	Issued	
Transport and Communication	The Eritrean Port Regulation	2005	Issued	
	Transportation of Goods Regulation	2002	Issued	
	Land Transport Proclamation	2000	Issued	
Science and Technology	The Eritrean Science and Technology Development Agency Establishment Proclamation	1993	Issued	
Finance	Customs Proclamation	2002	Issued	
	Customs Regulation, Legal Notice No. 52	2001	Issued	
	Reporting of Imported Goods, Legal Notice No. 54	2002	Issued	
	Regulations of the Storage of Goods in Customs Post, Legal Notice No. 77	2003	Issued	
	Eritrean Free Zones Proclamation No. 115/2001	2001	Issued	
Maritime Transport	Regulation for Prevention of Pollution from Ships	2005	Drafted	
	Regulation for Prevention of Pollution by Sewage	2005	Drafted	
Energy and Mines	Proclamation No. 68/1995 and Legal Notice No.19/1995	1995	Issued	

climate pattern with altitudes that range from 120 meters below sea level to over 3,000 meters above sea level. In regard to climate, soil types and other parameters, Eritrea is divided into six agro-ecological zones (Figure 1 shows ecological zones): (i) Moist Highlands, (ii) Arid Highlands, (iii) Sub-Humid Highlands, (iv) Moist Lowlands, (v) Arid Lowlands and (vi) Semi-Desert. Mean annual temperature ranges from 1°C in the Moist and Arid Highlands to 32°C in the Semi-Desert. Annual precipitation varies from less than 200 mm in the Semi-Desert to 800 mm in the Sub-Humid Zone. Over half of the total land area is not suitable for conventional agriculture due to steep topography and unreliable rainfall conditions.

The coastal plains which are found adjacent to the Red Sea shoreline extend about 1350 km from the southern tip to the north. The most serious climatic condition of the coastal zone is the shortage of rainfall for agricultural, domestic and other uses.

#### E. Land Degradation

Land is the most important part of Eritrean natural resources and most of the Eritrean population livelihood depends on it. Land degradation is mainly caused by natural phenomenon such as climate change, drought, erosion, deforestation and anthropogenic activities. Excessive exploitation of land resources by successive colonial administrations exacerbated land degradation. To stop further land degradation, the government has undertaken several activities, among others, soil and water conservation, community-based afforestation programmes, and establishment of protected areas. Moreover, it has developed guidelines and regulations and policies such as the Land Reform proclamation that contributes to the protection of land degradation.

#### F. Pollution from Chemicals and Wastes

The general wastes could possibly pollute the environment if they are not properly managed and controlled. These wastes may generate potentially hazardous chemicals that pollute the air, water and soil. The government of Eritrea gives a great attention and conducts extensive safety actions toward environment and strives to protect the air, water, and the soil from pollution by hazardous chemicals that are released from different sources<sup>25</sup>.

### 1.5.2 National Policy, Regulatory and Legal Frameworks

The State of Eritrea has been dealing with the conservation and protection of the environment. In its Macro Policy of November 1994, the Government reiterated that one of the principal national development objectives is “an upgraded and safeguarded environment that is free from pollution”. In line with these policy frameworks, Eritrea has issued several regulatory frameworks, action plans as shown in Table 1.1.

#### A. National Adaptation Program of Action

The National Adaptation Program of Action (NAPA) was developed in April 2007 by reviewing the existing studies and on the basis of stakeholders input. The main objective

of NAPA is to address the climate variability and climate change that could influence negatively the livelihood of the rural and urban population of Eritrea.

#### B. National Action Plan for Combating Desertification

The United Nations Convention to Combat Desertification (UNCCD) was the first international convention that Eritrea signed and ratified, in 1994. The Purpose of the plan is to identify the factors contributing to desertification, and to find practical measures to combat desertification and/or to mitigate the effects of drought. The plan is expected to incorporate long-term strategies to combat desertification and be integrated with national policies for sustainable development.

#### C. National Biodiversity Strategic Action Plan

The revised National Biodiversity strategy and action Plan (2015) set up a target concerning environmental pollution; “E-Target 15. By 2020, Pollution to agricultural biodiversity from agro-chemicals has been brought to levels that are not detrimental to ecosystem function and biodiversity”. This target calls for effective implementation of environmental assessment, regulation of agrochemical imports and supply to ensure proper pesticide use and promote the framework of Integrated Pest Management (IPM).

#### D. The National Environmental Management Plan

The National Environmental Management Plan (NEMP) was adopted in 1997 with the objective of ensuring that human activities in both terrestrial and marine areas would result in long-lasting global environmental benefits.

#### E. Eritrea’s Second National Communication

The Eritrea’s Second National communication (SNC) was prepared in 2012 under the United Nations Framework Convention on Climate Change (UNFCCC). Eritrea has acknowledged that climate change is a global challenge and should be approached by collective actions of both developed and developing nations. As a Party to the Convention, Eritrea is willing to contribute in all aspects of its commitment to the achievement of the ultimate objective of the Convention. In this document, climate change vulnerability and adaptation assessment, GHG inventory, key source categories of greenhouse gases identification and mitigation assessment are the major components.

#### F. National Rural Sanitation Policy

The National Rural Sanitation Policy was developed in August 2007 by the Ministry of Health. Its purpose is to guide individuals, households, institutions, communities and their leaders in the rural areas, as well as governmental staff at all levels and development partners, to achieve universally safe and sustainable sanitation and hygiene practices. This will improve the health and living conditions of the rural communities in Eritrea. This Policy will create the basis for related legislation, and regulatory and supportive framework for implementation.



## G. Health sector strategic development plan

This Health Sector Strategic and Development Plan 2010-2014 is developed on the basis of the National Health Policy and strives to attain the following goals:

- Significantly reduce the burden of early childhood illness and improve maternal and child health/development
- Control communicable diseases with an aim of reducing them to a non-public health problem.
- Prevent, control and manage non-communicable diseases.
- Strengthen cross cutting health interventions
- Enhance efficiency, equity and quality of service delivery through health systems development

### 1.5.3 International Environmental Conventions

Understanding the overall importance of issues associated with hazardous chemicals such as pesticides, the Government of Eritrea has reacted in a number of ways to address the problems. Eritrea has developed laws and regulations pertinent to sound management of chemicals. The country also recognizes the global nature of human health and environmental problems of chemicals. To join with the global community in ensuring the sound management of chemicals, Eritrea is a party to a number of global environmental conventions as shown in Table 1.2, and specifically to the following four international conventions on chemicals. By being a Party to various international environmental conventions, Eritrea gains the following benefits:

- Allow Eritrea to dispose of hazardous waste especially obsolete pesticides, in countries that have suitable technologies to treat such wastes;
- Prevent Eritrea from becoming a dumping ground for hazardous chemicals produced elsewhere in other countries;
- Prevent accumulation of hazardous waste in Eritrea;
- Develop capacity for the sound management of chemicals in Eritrea; and
- Enable Eritrea to contribute to the global efforts in the elimination/reduction of hazardous chemicals pollution.

#### A. The Rotterdam Convention, Prior Informed Consent (PIC)

Eritrea acceded to the Convention in March 2005. The objective of the Convention is to promote shared responsibility and cooperative efforts among Parties in the international trade of certain banned or severely restricted hazardous chemicals and severely hazardous pesticides formulations, in order to protect human health and the environment from potential harm.

#### B. The Basel Convention on Trans-Boundary Movement of Hazardous Waste and their Disposal

Eritrea acceded to the Basel Convention on Trans-Boundary Movement of Hazardous Waste and their Disposal Convention in March 2005. The objective of the Convention is to protect human health and the environment by controlling the trans boundary movements of Hazardous Wastes and Other Wastes (HWWO).

The Convention aspires to ensure environmentally safe transfer, disposal of hazardous wastes, and limiting “toxic trade” in hazardous wastes. In compliance with the requirements of the Basel Convention, Eritrea has transported and disposed of 364 tons of obsolete pesticides in an environmentally sound manner. Currently, the country has developed a national compliance action plan and national methodology for HWWO inventory, a first generation inventory of HWWO, including the legislation on hazardous wastes and other wastes.

#### C. The Stockholm Convention on Persistent Organic Pollutant (POPs)

Eritrea became a party to the Stockholm Convention in March 2005. The objective of this Convention is to protect human health and the environment from POPs. The Convention originally covered 12 chemicals. However, in May 2009, nine additional chemicals were listed as POPs and in May 2010, endosulfan was listed as the twenty-second POP. In accordance with Article 7 of the Convention, Eritrea prepared its initial National Implementation Plan (NIP) in 2012 and implemented some of the proposed actions as mentioned under the Basel Convention on Trans-Boundary Movement of Hazardous Waste and their Disposal. Further, in 2018, the NIP was revised and updated and covered the management of POPs chemicals that had not be addressed in the initial NIP.

#### D. The Vienna Convention and the Montreal Protocol on Substance that Deplete the Ozone Layer (ODS)

Eritrea became a party to this Convention in March 2005. The objective of the protocol is to protect the Ozone layer depletion by phasing ozone depleting substance (ODS). Eritrea has undertaken several measures to ensure sound management of ODS. The Country promulgated the first ODS regulations (Legal Notice 117/2010) to control imports and phased out the first group of ODSs (Chlorofluorocarbons) and appreciably reduced the import/use of hydro-chlorofluorocarbons (HCFCs). Moreover, Eritrea trained and equipped refrigeration and air-conditioning technicians with the necessary tools and also established three training centres.

#### E. MARPOL, International Convention for the Prevention of Pollution from Ships

Eritrea is not a party to MARPOL but has accessed the contents of the international agreement and thus drafted some national laws on the protection of marine environment. MARPOL was developed in 1973 and modified by the 1978 and 1997 protocols and various Annexes.

Table 1.2: List of Multilateral Environmental Agreements to which Eritrea is Party

Title of Treaty or Convention	Type of Action	Date of Deposit
Nagoya Protocol on Access and Benefit Sharing	Accession	11 June 2019
Vienna Convention for the Protection of the Ozone Layer, Vienna, 22/03/85	Accession	10 March 2005
Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 16/09/1987	Accession	10 March 2005
Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 29/06/1990	Accession	5 July 2005
Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 17/09/1997	Accession	5 July 2005
Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 17/09/1997	Accession	5 July 2005
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 22/03/1989	Accession	10 March 2005 (Entry into force 08 June 2005)
United Nations Framework Convention on Climate Change, New York 09/03/1992	Signature and Ratification	28 July 2005 and 22 April 2016
Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto 11/12/1997	Accession	28 July 2005
Convention on Biological Diversity, Rio de Janeiro 06/05/1992	Ratification and Accession	21 March 1996 and 19 June 1996
Cartagena Protocol on the Prevention of Biotechnological Hazards Relating to the Convention on Biological Diversity, Montreal, 29/01/2000	Ratification and Accession	10 March 2005 and 8 June 2005
United Nations Convention to combat Desertification (UNCCD), 14/10/1994	Signature and Ratification	14 October 1994 and 14 August 1996
Rotterdam Convention on the Prior Informed Consent Procedure, applicable in the case of certain hazardous chemicals and pesticides which are the subject of international trade, Rotterdam, 10/09/1998.	Accession	10 March 2005
Stockholm Convention on Persistent Organic Pollutants, Stockholm, 22/05/2001.	Accession and entry into force	10 March 2005 and 8 June 2005

Table 1.3: Summary of country profile data for Eritrea

<b>Capital</b>	Asmara
<b>Languages</b>	Tigrinya, Arabic, English,
<b>Independence</b>	Liberation date on May 24, 1991 and became a sovereign state in 1993 <sup>26</sup>
<b>Population</b>	3.2 million (2010) <sup>27</sup>
<b>Local Currency</b>	Eritrean Nakfa
<b>Area</b>	Approximately 125,000 square km <sup>28</sup>
<b>Land boundaries</b>	Djibouti, Ethiopia and Sudan
<b>Coastline</b>	Red Sea
<b>Climate</b> <sup>29</sup>	<ul style="list-style-type: none"> <li>Higher altitudes: vegetative cover and fertile soils favourable to agriculture</li> <li>Asmara (2,350 meters a.s.l): average temperature 16°C; receives around 500 mm of rain per year</li> <li>Highlands: very hot summers (around 30°C in May) and cold winters from December to February 17°C Sea level along the coast and western lowlands: high temperatures from June to September (40 - 50°C); rainy season from December to February (20 to 35°C)</li> </ul>
<b>Land Use</b>	<ul style="list-style-type: none"> <li>Total cultivable surface estimated at 1.6 million ha.</li> <li>Total cultivated area: 503 000 ha in 2002<sup>30</sup></li> </ul>
<b>Environmental Issues</b> <sup>31</sup>	<ul style="list-style-type: none"> <li>Salinity in aquifers in coastal areas</li> <li>Fluoride and bacteriological contamination</li> <li>Pollution due to domestic sewage</li> </ul>
<b>Ethnic groups</b>	Recognized ethnic groups <sup>32</sup> : Tigrinya, Tigre, Saho, Bedawiyet, Afar, Bilen and Rashaida, Kunama and Nara

26- [https://en.wikipedia.org/wiki/Independence\\_Day\\_\(Eritrea\)](https://en.wikipedia.org/wiki/Independence_Day_(Eritrea))

27- [http://www.newworldencyclopedia.org/entry/Eritrean\\_War\\_of\\_Independence](http://www.newworldencyclopedia.org/entry/Eritrean_War_of_Independence)

28- National Statistics Office [Eritrea]. 2013. Eritrea Population and Health survey 2010. Asmara, Eritrea,

29- National Statistics Office.

30- Eritrea. 2010. Eritrea Mining Journal

31- <http://www.eritrea.be/old/eritrea-climate.htm>

32- [http://www.fao.org/nr/water/aquastat/countries\\_regions/ERI/ERI-CP\\_eng.pdf](http://www.fao.org/nr/water/aquastat/countries_regions/ERI/ERI-CP_eng.pdf)

33- [http://www.fao.org/nr/water/aquastat/countries\\_regions/ERI/ERI-CP\\_eng.pdf](http://www.fao.org/nr/water/aquastat/countries_regions/ERI/ERI-CP_eng.pdf)

34- <http://worldpopulationreview.com/countries/eritrea-population/>

## 2. MERCURY INVENTORY: IDENTIFICATION OF INPUTS, EMISSIONS AND RELEASES IN ERITREA

### 2.1. Introduction

Mercury is released to the environment as a result of natural and human activities, like soil erosion, weathering of rocks, volcanic eruptions, burning of forests and anthropogenic activities. The amount of mercury mobilized and released thereby into the biosphere has increased since the beginning of human use of mercury, especially since the onset of the industrial age. Most of the mercury in the atmosphere is elemental mercury vapour, which circulates in the atmosphere for up to a year and can be widely dispersed and transported globally, whereas mercury in water, soil, sediments, or plants and animals is in the form of inorganic mercury salts and organic forms of mercury (for example, methylmercury). The inorganic form of mercury when either bound to airborne particles or in a gaseous form is readily removed from the atmosphere by precipitation and can also be dry deposited. Wet deposition is the primary mechanism for transporting mercury from the atmosphere to surface waters and land. Even after its deposition, mercury commonly is emitted back to the atmosphere either as a gas or associated with particles, to be re-deposited elsewhere.

Mercury is used for amalgamating process to extract gold from rocks which are mostly used in artisanal small-scale gold mining. It is also applicable in silver-coloured dental fillings (amalgams) and used in various equipment. The products which contain mercury are, among others, thermometers, thermostats, barometers, some electrical switches and relays, some light sources, batteries or skin-lightening cosmetics.

The mercury released from different sources could potentially contaminate the sites around it. In general, a contaminated site is a place where there is an accumulation of toxic substances or residues. This may affect the soil, groundwater, sediments and even air as in the case of mercury to levels that pose a risk to the environment or human health or be above the recommended limits for a specific use.

The national mercury inventory, including suspected mercury contaminated sites, was prepared by a team of experts from different key institutions and under the guidance of the Bureau of Standard and Evaluation. The main objective in preparing a mercury inventory and suspected contaminated sites report was to identify the key sources of mercury releases and potentially contaminated sites in Eritrea. The process of preparing the inventory began in February 2018, when UNITAR organized a training workshop on the toolkit methodology in Asmara. The training workshop was attended by the team of experts responsible for the inventory, as well as a wider group of different stakeholders from government institutions.

### 2.2. Methodology for Inventory

This section explains the methodology applied for the inventory and identification of the potentially contaminated sites. The inventory was developed in 2018 and in order to avoid irregularity on the input data, data of the year 2016 were taken in almost all of the categories of the inventory. However, some data gaps have been encountered on the given year for some categories and data of more relevance for the given year were taken.

This mercury release inventory has been estimated through the use of the “Toolkit for identification and quantification of mercury releases” developed by the Chemicals and Health Branch of the United Nations Environment Programme.

In order to calculate the mercury input from different categories to the environment within the country, the Toolkit Level 2 was used, as it is seen with its parameters and the mercury to gold ratio of the national ASGM investigating team as relevant to Eritrea. For countercheck purpose, the Toolkit Level 1 is also included in Table 2.2. Table 2.1 provides general descriptions and definitions of the output pathways identified as the types of results of this inventory. These are emissions and releases to air, water, land by product and impurities, general waste and sector specific waste treatment.

For all cases of mercury inputs and mercury emissions and releases, it is important to note the following aspects for total calculations:

To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration sources, waste deposition and informal dumping is included in the total for mercury inputs. This 10% represents approximately the mercury input to waste from materials, which are not quantified individually in inventory Level 2 of the toolkit.

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

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

To avoid double counting of mercury in products produced domestically and sold on the domestic market (including oil and gas), only the part of mercury inputs released from production are included in the input TOTALS.

To avoid double counting, fossil fuel mercury contributions to cement production was subtracted automatically in the TOTALS.

### 2.3. Sources of Mercury Inputs to Society in Eritrea

Table 2.2 illustrates the anthropogenic mercury release sources that were identified as present or absent in the country. Only source types identified as potentially present are included in the quantitative assessment of this report.

Mercury inputs to society should be understood here as the mercury amounts made available for potential releases through economic activities in the country. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, and fluorescent light bulbs. It also includes mercury mobilized via extraction and use of raw materials which contain mercury in trace concentrations.

The activity rate for each sub-source category has been established based on the available information. A simple mass-balance calculation has been presented in the following tables to illustrate how the Toolkit functions, and the mercury input from each source-category is calculated. It is worth noticing that the Level 2 Toolkit uses pre-defined default input factors, which are defined using available scientific literature. However, the ones used as default factors are also a source of uncertainty in this inventory, as these factors are known to vary from country to country.

The inventory team preferred using the Toolkit Level 2 to calculate the mercury emission and releases in the country and used partially country-specific input and output factors. Therefore, it is to be noted that the inventory team used the gold to mercury ratio of 1:1.1 and the activity rate of 185 kg/year gold applied by the national ASGM investigating team.

Table 2.1: Description of the types of results of the national inventory

Calculation result type	Description
<b>Estimated Hg input, Kg /y</b>	The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury amount in coal used annually in the country for combustion in cement production plants.
<b>Air</b>	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example: <ul style="list-style-type: none"> <li>• Point sources such as coal fired cement production plants, waste incineration;</li> <li>• Diffuse sources such as small-scale gold mining, informal burning of waste with fluorescent lamps, batteries, thermometers.</li> </ul>
<b>Water</b>	Mercury releases to aquatic environments and to waste water systems; point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example: <ul style="list-style-type: none"> <li>• Wet flue gas cleaning systems on coal fired cement production plants;</li> <li>• Industry, households, etc. to aquatic environments;</li> <li>• Surface run-off and leachate from mercury contaminated soil and waste dumps.</li> </ul>
<b>Land</b>	Mercury releases to the terrestrial environment: General soil and ground water. For example: <ul style="list-style-type: none"> <li>• Solid residues from flue gas cleaning on coal fired cement production plants;</li> <li>• Uncollected waste products dumped or buried informally;</li> <li>• Local unconfined releases from industry such as on-site hazardous waste storage/burial;</li> <li>• Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer);</li> <li>• Application on land, seeds or seedlings of pesticides with mercury compounds.</li> </ul>
<b>By-products and impurities</b>	By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, for example: <ul style="list-style-type: none"> <li>• Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants;</li> <li>• Sulphuric acid produced from desulphurization of flue gas (flue gas cleaning) in non-ferrous metal plants with trace concentrations mercury</li> <li>• Chlorine and sodium hydroxide produced with mercury-based chlor-alkali technology with trace concentrations mercury</li> <li>• Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations).</li> </ul>
<b>General waste</b>	General waste: Also considered as municipal waste in some countries. Typically, household and institutional waste where the waste may be subject to incineration, land filling or informal dumping. The mercury sources in waste are consumer products with intentional mercury content (e.g. batteries, thermometers, fluorescent tubes) as well as high volume waste like printed paper and plastic, with small trace concentrations of mercury.
<b>Sector specific waste treatment /disposal</b>	aste from industry and consumers which is collected and treated in separate systems, and in some cases recycled, for example: <ul style="list-style-type: none"> <li>• Confined deposition of solid residues from flue gas cleaning on coal fired power plants on dedicated sites;</li> <li>• Hazardous industrial with mercury content, which is deposited in dedicated, safe sites;</li> <li>• Hazardous consumer waste with mercury content, mainly separately collected and safely treated: e.g. batteries, thermometers, mercury switches, lost teeth with amalgam fillings;</li> <li>• Confined deposition of tailings and high-volume rock/waste from extraction of non-ferrous metals.</li> </ul>

Table 2.2: Identification of mercury release sources in the country; Sources present (Y), and possible, but not identified positively (?)

Source category	Source present Y/?	Estimated mercury input (kg Hg/year)	
		Level 1	Level 2
<b>Energy consumption</b>			
Other coal uses	Y	6	7
Combustion/use of petroleum coke and heavy oil	Y	4	2
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	Y	1	
Use of raw or pre-cleaned natural gas	Y	0	0
Biomass fired power and heat production	Y	36	36
Charcoal combustion	Y	0	
<b>Primary metal production</b>			
Gold extraction by methods other than mercury amalgamation	Y	12,375	4538
Gold extraction with mercury amalgamation - from concentrate	Y	241	204
<b>Other materials production</b>			
Cement production	Y	63	63
<b>Use and disposal of products with mercury content</b>			
Dental amalgam fillings ("silver" fillings)	Y	13	13
Thermometers	Y	30	30
Electrical switches and relays with mercury	Y	143	143
Light sources with mercury	Y	2	1
Batteries with mercury	Y	167	166
Paints with mercury preservatives	Y	72	72
Skin lightening creams and soaps with mercury chemicals	Y	30	30
Medical blood pressure gauges (mercury sphygmomanometers)	Y	365	371
Other manometers and gauges with mercury	Y	5	
Laboratory chemicals	Y	10	51
Other laboratory and medical equipment with mercury	Y	41	
<b>Waste incineration</b>			
Incineration of hazardous waste	?	?	
Incineration and burning of medical waste	Y	30	30
Open fire waste burning (on landfills and informally)	Y	794	159
<b>Waste deposition/landfilling and waste water treatment</b>			
Informal dumping of general waste	Y	1,852	370
<b>Crematoria and cemeteries</b>			
Cemeteries	Y	75	2
<b>TOTAL of quantified inputs (double accounting subtracted, see notes above)</b>		<b>13950</b>	<b>5816</b>

The mercury inventory (Level 2) revealed that gold and metal concentrate production, use and disposal of mercury containing products as well as waste management are the most significant sources of mercury inputs, emissions and releases in Eritrea. There are no sources of mercury releases from fuel production, production of chemical polymers, production of products with mercury content, and production of recycled products. In accordance with the MIA report, quantitative assessment is made only for the categories identified as contributing to emissions and releases in Eritrea.

It should also be noted that some minor sources assumed to emit mercury have not been included in this inventory, even if it is possible that these sources exist. Therefore,

the categories of sources presented in Table 2.3 have not been the subject of a study in this inventory but have nevertheless been identified in the national territory.

In general, the estimate of mercury inputs to Eritrean society is lower for Level 2 as compared to

Level 1. However, it is noted that the subcategories that contribute most to these inputs are similar between the two tiers. Indeed, the results for Level 2 also show that primary production of metals and the use of mercury-containing products are responsible for significant amounts of mercury in Eritrean society.

Moreover, according to Level 1 and Level 2, gold extraction with Hg-amalgamation revealed almost the same



amount 240.5 Kg Hg/year and 204 kg Hg/year respectively. For gold extraction by methods other than mercury amalgamation, the discrepancy between the results of Level 1 (12375 Kg Hg/year) and Level 2 (4538 Kg Hg/year) is very significant.

## 2.4. Summary of Sources of Mercury Emissions and Releases in Eritrea

The key mercury releases here are releases to air, to water (marine and freshwater bodies, including via wastewater systems), to land (general waste and sectors of specific waste treatment). An additional output pathway is “by-products and impurities” which designate mercury flows back into the market with products and by-products where mercury does not play an intentional role (Table-2.4). Releases are calculated using pre-defined output distribution factors used in the level 2 Toolkit.

### 2.4.1. Mercury Releases to Water

Estimated mercury releases to water are shown in Figure 2.1. The categories include all releases to aquatic environments, surface waters, and wastewater systems. Sources of releases can be of two natures: sources located at a fixed point (for example a factory) or diffuse sources from which mercury can be dispersed and reach marine environments (oceans) and fresh waters (rivers and lakes).

Regarding the Level 2, the most significant sources of releases into water are:

- Other product/process use (41% or 133.81 kg Hg/year);
- Primary (virgin) metal production (35% or 115.2 kg Hg/year);
- Consumer products (13% or 44.2 kg Hg/year);
- Waste deposition and wastewater treatment (11% or 37.05 kg Hg/year).

### ESTIMATED MERCURY EMISSIONS TO WATER (KG HG/YEAR)

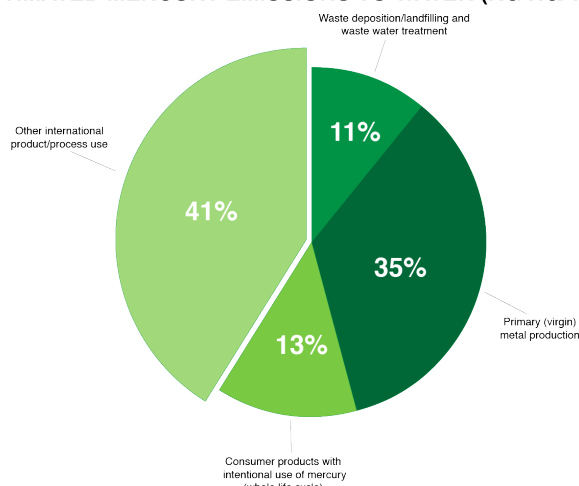


Figure 2.1: Estimated mercury releases to water, inventory Level 2

### 2.4.2. Mercury Releases to Soil

Estimated mercury releases to soil are presented in Figure 2.2. Similarly, releases to land are of two natures: sources at a fixed point or diffuse sources from which mercury may be dispersed.

### ESTIMATED MERCURY EMISSIONS TO LAND (KG HG/YEAR)

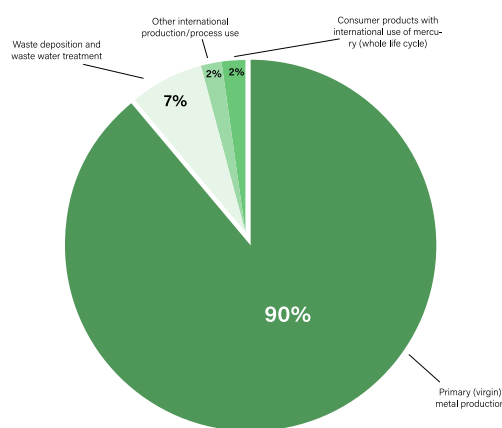


Figure 2.2: Estimated releases to land, inventory level 2

Table 2.4: Source categories and Hg emissions/releases

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	45.1	-	-	-	-	-	45	1%
5.2: Primary (virgin) metal production	388.2	115.2	4,106.1	181.5	-	-	4,741	79%
5.3: Production of other minerals and materials with mercury impurities*1	44.3	-	-	12.7	-	6.3	63	1%
5.4: Intentional use of mercury in industrial processes	-	-	-	-	-	-	-	0%
5.5: Consumer products with intentional use of mercury (whole life cycle)	122.4	44.2	78.5	-	227.1	0.8	472	8%
5.6: Other intentional product/process use*2	74.4	133.8	75.2	0.8	130.7	20.0	435	7%
5.7: Production of recycled metals	-	-	-	-	-	-	-	0%
5.8: Waste incineration and burning	188.8	-	-	-	-	-	189	3%
5.9: Waste deposition/landfilling and waste water treatment*3*4	37.0	37.0	296.4	-	-	-	370	1%
5.10: Crematoria and cemeteries	-	-	2.5	-	-	-	2	0%
<b>SUM OF QUANTIFIED RELEASES*3*4</b>	<b>850</b>	<b>330</b>	<b>4,262</b>	<b>195</b>	<b>358</b>	<b>27</b>	<b>6,023</b>	<b>100%</b>

Regarding the Level 2, the sources that contribute the most to mercury releases into soil are the following:

- Primary (virgin) metal production (90% or 4106.13 kg Hg/year);
- Waste deposition and wastewater treatment (6% or 296.4 kg Hg/year);

### 2.4.3. Mercury Emissions to Air

Estimates of mercury emissions to air are shown in Figure 2.3. Air emission is any evaporation of mercury in the form of vapour, for instance, the aerosols that may result from heating.

As for the inventory Level 2, the most significant sources of emissions are:

- Primary (virgin) metal production (40% or 338.19 kg Hg/year);
- Waste incineration and burning (22% or 188.8 kg Hg/year);
- Consumer products (15% or 122.4 kg Hg/year);
- Other product/process use (9% or 74.4 kg Hg/year).

### ESTIMATED MERCURY EMISSIONS TO AIR(KG HG/YEAR)

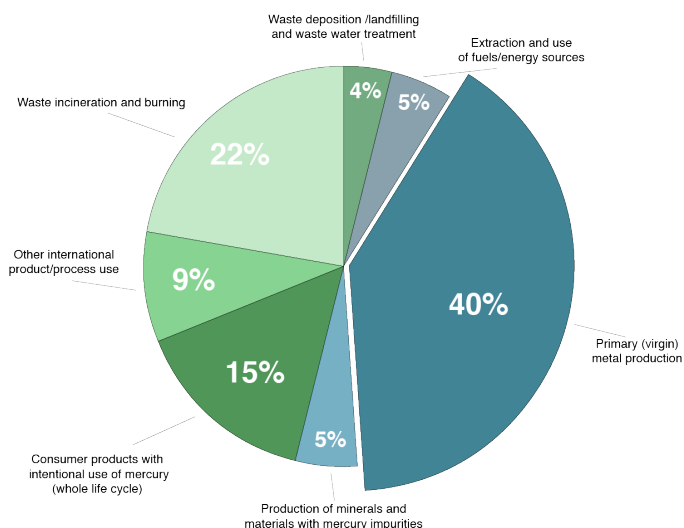


Figure 2.3: Estimated releases to air, inventory Level 2

## 2.5. Data and Inventory: Energy Consumption

Power generation still remains critical to investment opportunities in the country. With the the Hirgigo Power Plant in place, the power generating capacity of the country was boosted from 35 MW in 1991 to more than 135 MW in 2003<sup>33</sup>. To date, the total power generation capacity is raised to 191 MW. The growing effort to introduce renewable energy to the electricity generation capacity is estimated about 7.3% of the total electricity generation. The energy consumption in Eritrea is based on import of fuels for different sectors like power supply, transportation and industries. According to the information provided by the Department of Energy of the Ministry of Energy and Mines, the distribution of electricity from Hirgigo power generation and renewable energy sources covers around 38% of the population<sup>34</sup>. Most cities and some vil-

lages do benefit from this power supply. A considerable portion of the rural population uses biomass for energy, mainly for heating and food cooking purposes.

### 2.5.1. Other Coal Uses

This sub-category contributes to an estimated input of mercury of 7 kg Hg/year. Currently, Ghedem cement factory uses coal combustion for roasting purposes in its cement production (Figure 2.5). It can equally use heavy oil for the same purpose. Both coal and heavy oil are imported to the country. Based on the information provided by the factory, it consumes ca. 46,500 ton/year of coal to produce 480,000 ton/year of Portland cement. This roughly corresponds to 7 kg of mercury input from coal per year (using Toolkit default factors). However, this is only when it runs at full capacity.



Figure 2.4: Open storage yard of coal for use in the cement production

The factory uses only the electrostatic simple precipitator (ESP) and back filter to control air pollution during the process. Although in trace amount, mercury is included in coal, therefore, its combustion for whatsoever purpose could be a source of mercury emission to the environment.

### 2.5.2. Combustion / Use of Petroleum Coke and Heavy Oil

It is important to note that combustion and use of fossil fuel in general affect the environment, due to the emissions and releases of mercury in the processes. According Toolkit level 2, this sub-category comprises the combustion/use of petroleum coke, heavy oil, diesel, gasoil, petroleum, kerosene, LPG, and other light to medium distillates. Together they contribute an estimated input of mercury of

2 kg Hg/year. So, extra care should be taken on the combustion and use of fossil fuel to minimize the mercury emission and release. The sectors that use heavy oil for industrial and power generating purpose are described in Table 2.6. Table 2.6 represents the import of heavy oil and its distribution to the different sectors in 2016 in the country. The total imported heavy oil for the period 2010-2016 is summarized, for the purpose of calculating the energy consumption and its potential releases of mercury. To determine the mercury release from this consumption the data on the import of heavy oil for 2016 was considered. Considering the density of furnace oil to be ca.0.87 t/m<sup>3</sup>, the furnace oil consumption in 2016 was around 2784 t.

Table 2.5: Inputs, emissions and releases of mercury from sub-categories of energy consumption

Source category	Estimated Hg releases, standard estimates, Kg Hg/y							
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land	General waste	By-products and impurities	General waste	Sector specific waste treatment /disposal
<b>Energy consumption</b>								
Combustion/use of petroleum coke and heavy oil								
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	2	2	0	0	0	0	0	0
Use of raw or pre-cleaned natural gas	0	0	0	0	0	0	0	0
Biomass fired power and heat production	36	36	0	0	0	0	0	0
Charcoal combustion	0	0	0	0	0	0	0	0

Table 2.6: Importation and distribution of furnace oil in 2016 in litre (Libya Oil Eritrea Petroleum)

No.	Sector	Gasoil (Lt)	Benzene (Lt)	Kerosene (Lt)	Furnace Oil (Lt)
1	Government	34788800	881349	276035	88469
2	Construction	2299970	15257	46173	15364
3	Industry	970075			146874
4	Power Plant	2865011			2948766
Total					3199473

Table 2.7: Importation and distribution of Gasoil, Benzene and Kerosene (Libya Oil Eritrea Petroleum)

No.	Sector	Gasoil (Lt)	Benzene (Lt)	Kerosene (Lt)
1	Agriculture	17,791	-	-
2	Government	34,788,800	881,349	276,035
3	Transport	5,357,440	154	14
4	Construction	2,299,970	15257	46,173
5	Industry	970,075	-	-
6	Mining	53,561	-	-
7	Power Plant	2,865,011	-	-
8	Others	4,179	-	-
<b>Total</b>		<b>46,356,827</b>	<b>896,760</b>	<b>322,222</b>

Table 2.8: Road performance and Fuel consumption of Vehicles

Bus	Size	Annual road performance (Km/a)	Fuel Consumption (Km/liter)	liter/km	Lt/a
	Large	28,888	2	0.5	12,465,172
Medium	7,488	3	0.333	3,277,248	
Small	12,711	8	0.125	4,135,841.62	
<b>Total</b>					<b>19,878,261.6</b>
Truck	Heavy	19,320	1.2	0.83333	216,995,800
	Medium	13,800	1.6	0.625	66,007,125
	Light	12,600	5	0.2	11,156,040
<b>Total</b>					<b>294,158,965</b>

Light fuel is used in various sectors including transport as described in Table 2.7. Though no figures on the numbers of generators are available in the country, a considerable number of generators of various capacities use diesel oil and gasoil for their operations. Kerosene is mainly used in the domestic area for cooking and lighting purposes. The combustion of light fuel is used in different sectors particularly in transportation and Eritrean Electricity Corporation. Most vehicles in Eritrea use diesel oil as compared to benzene. Considering the density of this oil to

be 0.85 t/m<sup>3</sup>, the total light oil consumption would be around 40439.44t/y.

According to the road performance of vehicles in Eritrea and the input data from Ministry of Transport and Communication, fuel consumption per year is presented in Table 2.8. Assuming a density of 0.85 t/m<sup>3</sup> of this oil, the total oil consumption in tons per year for both types of vehicles corresponds 266,829 t/y<sup>35</sup>.

### 2.5.3. Biomass Fired Power and Heat Production for Household Needs

This sub-category contributes to an estimated input of mercury of 36 kg Hg/year. Based on the data available from the Department of Energy from 1997 to 2009 (Table 2.9), as presented in the table below, the country does not have any biomass-fired power production and except that biomass issued in households for heat and cooking purposes. For calculating and estimating the emissions of mercury from the biomass (wood and charcoal), the consumption of the 2009 was used. It is to be noted that many families use the award-winning Eritrea-innovated oven “Adhanet” to strongly minimize the fire wood consumption. This, in turn, means lower emissions of mercury, GHGs (converts Methane to CO<sub>2</sub>, which has less

GHG potential) and PCDD/F.

### 2.5.4. Charcoal Combustion

The production of charcoal in Eritrea corresponds to the wood consumption for heat production. Most of the rural and some portion of the urban population use charcoal for cooking their daily food and heating. Charcoal is also used for the daily traditional Eritrean coffee ceremony which is practised in many households. Table 2.10 shows the consumption of charcoal from 1997-2009 in Eritrea but it includes the biomass (wood) consumption which is excluded in the toolkit calculation. Given the data entered in the Toolkit, charcoal combustion does not contribute to mercury inputs into Eritrean society.

Table 2.9: Biomass consumption

No	Fuel Type	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>charcoal-in '1000' tons</b>														
1	Public/ Commercial	3.72	2.69	2.69	2.77	2.85	2.93	3.02	2.85	2.93	3.02	3.11	3.2	3.3
2	Household	121.11	70.69	72.81	75	77.13	79.54	81.96	107.66	110.95	114.34	117.8	121.4	125.1
<b>Total consumption</b>		124.83	73.38	75.5	77.77	79.98	82.47	84.98	110.51	113.88	117.36	120.9	124.6	128.4

Table 2.10: Total consumption of Charcoal from 1997-2009

No	Fuel Type	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<b>Fuel Wood-in '1000' tons</b>														
1	Input At charcoal Kilns	213.9	111.84	115.2	110.4	126	129.98	134	148.74	163.23	168.41	173.8	179.3	185
2	Public/ Commercial	45.8	30.18	31.09	32	32.96	33.95	34.97	31.06	31.99	32.95	33.94	34.96	36.01
3	Household	1372.4	800.5	824.5	849.2	863.86	890.28	916.62	846.7	871.6	897.25	923.7	950.8	979.9
<b>Total consumption</b>		1,632.1	942.52	970.8	991.6	1,022.8	924.23	1,085.6	1,026.5	1,066.82	1,098.6	1,131	1,165	1,201

Table 2.11: Mercury in primary metal production

Source category	Estimated Hg releases, standard estimates, Kg Hg/y						
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
<b>Energy consumption</b>							
<b>Gold extraction by methods other than mercury amalgamation</b>	4538	182	91	4084	182	0.0	0.0
<b>Gold extraction with mercury amalgamation - from concentrate</b>	204	157	24	22	0.0	0.0	0.0

Table 2.12: Hg-concentration from different soil samples from the Bisha mining pit

PPM	Frequency
0-1	52504
1-5	73992
5-10	4184
10-100	1112
100-1000	31
1000-1000000	1
<b>Total Samples</b>	131824



## 2.6. Data and Inventory on Primary Metal Production

In general, Eritrea does not produce any metal neither for domestic nor external use. Industrial gold bullions are produced and exported by the two mining companies, Bisha Mining Sh.Co. (BMSC) and Zara Mining Sh.Co. (ZMSC). In addition, the BMSC produces both zinc and copper concentrates from the ore. The aforementioned metal concentrates are exported to smelters, as there is no smelting industry in the country. Table 2.11 explains the results of the inventory for both large scale industrial gold mining and ASGM.

### 2.6.1. Gold Extraction by Methods Other than Mercury Amalgamation

The two modern mining plants of the country, BMSC and ZMSC use cyanidation and Carbon-In-Leach (CIL) methods only for gold extraction. As it is generally known, the mercury occurrence and its concentration related to mining areas and whole ore may be acceptable but due to excavation of the mining pit, potential increment of mercury around the mining site can be expected if there is not any mercury treatment. As explained in Table 2.12, the result of mercury concentration from different soil samples from the Bisha mining pit was calculated using the Inductive Coupled Plasma (ICP).

### 2.6.2. Gold Extraction with Mercury Amalgamation from concentrate

Gold extraction and processing in Eritrea are conducted using rudimentary techniques and are labour intensive at all stages. In hard rock mines, ore is extracted with a chisel, sledge hammer and iron bars. In alluvial mines, ore is extracted with shovels and hoes. In both cases, the ore is put in bags of approximately 15 kgs and is either processed on site, or transported to another area where water is available. In the case of alluvial deposits, the ore is directly panned as the gold is already liberated by mechanical disintegration on the course of the stream. In the case of hard rock deposits, the gold particles are still hosted by gangue minerals (commonly quartz vein which may bear sulphides) and need to be further processed to be liberated. This is done by manual crushing, with the use of hammers. Subsequently, the crushed ore is milled to a smaller size using mortars to liberate the gold from the gangue, and is then panned.

Mercury is added in a very last stage, when most of the gangue mineral has been removed and only heavier materials such as iron still remain. The mercury and gold then



Figure 2.26: Google map of Asmara dumping site (Skariko)

form an amalgam, which is squeezed by hand in a piece of fabric to eliminate the excess liquid mercury not bound to gold, which is reused, sometimes up to three times.

Unlike large-scale gold mining, which is planned and centrally coordinated, artisanal gold mining is irregularly carried out and mostly done by individuals in Eritrea, artisanal gold mining has long been practised in Eritrea since time immemorial and gold panning and mercury amalgamation is practised in some sites, especially in the Gash-Barka, for example, Tilega, Zara (Figure 2.5), Anseba and Semienawi Keyih Bahri regions of Eritrea, which are located along the border to the Sudan, from where the mercury is believed to have been smuggled illegally. According the Toolkit Level 2, ASGM contributes to an estimated mercury input of 204 kg Hg/year.

## 2.7. Data and Inventory of other Materials' Production

Table 2.13 shows the results of the inventory for cement production, the only activity identified in the country in the category of other materials' production.



Figure 2.6: Ghedem Cement Factory

Table 2.13: Mercury releases in cement production

Source category	Estimated Hg releases, standard estimates, Kg Hg/y						
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
<b>Other materials' production</b>							
<b>Cement production</b>	63	44	0.0	0.0	13	0.0	6



This sub-category contributes to an input of mercury estimated at 63 kg Hg/year. 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 gravel to produce concrete. As such, it is an important material in many forms for the construction sector.

In Eritrea, there are two cement factories, the Massawa Cement Factory and the Ghedem Cement Factory which are located on the Red Sea coastal area around Massawa, that are operational, where-by the first, being old and unprofitable, is on the verge of closure. The total production rate of Portland cement from both factories, but mainly from Ghedem Cement Factory is around 480,000 ton/year and from which mercury may be released during the production of cement as shown in Figure 2.6. Mercury is present as a trace contaminant either in the raw materials, particularly the coral limestone, or the coal used for roasting it. The clinker is not imported. The fate of mercury generated during the production will depend on the production processes. It is volatilized in the kiln and bound to dust particles circulating between the kiln/preheated raw mill and dust precipitator, building up mercury concentrations in the system, unless dust is purged to the final cement or to waste deposits.

## 2.8. Data and Inventory on the Use and Disposal of Products with Mercury Content

### 2.8.1 Mercury in Dental Amalgam

Based on the toolkit and the population of Eritrea, the use of dental amalgam is found out to be 13 kg Hg/year that is released to the environment. In general, 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.

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 wastewater from dental clinics in the country. Traditionally, there is no practice of cremation in Eritrea; nevertheless, mercury release may occur from the burial of dead bodies with amalgam fillings. Out of the total amalgam prepared by the dental clinics for filling damaged teeth, ca. 46% are used towards that end and the rest is discarded in the process. In Eritrea, one can assume that many dental clinics do not have waste water treatment systems fitted with traps to capture and retain amalgam and do not have an environmentally sound means to dispose 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 are disposed in the trash, or they pass through the trap and are released to the sewer system. Old fillings or amalgam-containing teeth fillings that are removed at the dental clinics are typically disposed along general waste streams.

### 2.8.2 Mercury in Thermometers

The use of mercury thermometers contributes to a mercury input of 30 kg Hg/year. The quantity of imported thermometers to the country from the year 2008-2016 (Table 2.15) was gained from the Customs Office, as can be observed in the table below. There was no data or information available to the team regarding the various types of thermometers or why mercury thermometers are selected. Thermometers are mainly used for medical services in Eritrea.

The average data for imported thermometers from 2012-2016 was used for the calculation of the toolkit to estimate the release of mercury to the environment. Based on the feedback from the questionnaire distributed to medical service providers, damaged thermometers are generally the main concern for the environmental pollution from mercury release, either discarded as ordinary waste or

Table 2.14: The release of mercury from different mercury added products

Source category	Estimated Hg releases, standard estimates, Kg Hg/y						
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
<b>Use and disposal of products with mercury content</b>							
Dental amalgam fillings (“silver” fillings)	13	0	6	1	1	3	3
Thermometers	30	6	9	6	-	9	0
Electrical switches and relays with mercury	143	43	0	57	-	43	0
Light sources with mercury	1	0	0	0	0	0	0
Batteries with mercury	166	1	0	1	0	163	1
Paints with mercury preservatives	72	66	4	0	-	2	-
Skin lightening creams and soaps with mercury chemicals	30	0	29	2	-	0	0
Medical blood pressure gauges (mercury sphygmomanometers)	371	74	111	74	0	111	0
Other manometers and gauges with mercury							
Laboratory chemicals	51	0	17	0	0	17	17
Other laboratory and medical equipment with mercury							

disposed in the general waste dumping areas along with other medical waste.

### 2.8.3 Mercury in Electrical Switches and Relays

The use of electrical switches and relays contributes to a mercury input of 143 kg Hg/year. Mercury has traditionally been used in a great variety of electrical switches, relays, arc rectifiers and thermostats. These components have been used in various electrical and electronic equipment and vehicles. They are calculated automatically in the Toolkit based on population numbers and the electrification rate.

### 2.8.4 Mercury in Light Sources with Mercury

The use of mercury-containing light sources contributes to a mercury input of 1 kg Hg/year. Lamps containing mercury for both indoor and outdoor applications are commonly found in the country. From Part I of Annex A of the Convention, the following types are all known to be in the market: compact fluorescent lamps (fluorescent hot cathode), linear fluorescent lamps, high intensity discharge (includes metal halide, ceramic metal halide, high pressure sodium, and mercury vapour), mercury short-arc lamps. The import of different mercury-containing light sources through the Department of Customs was used as an approximation for consumption in the calculation of mercury release and considering the average from 2012-2016 (Table 2.16) in the spread sheet. Eritrea does not export any light source and so all the imported light sources were used for the calculation in the toolkit.

### 2.8.5 Mercury Batteries

The use of mercury-containing batteries contributes to a mercury input of 166 kg Hg/year, according to the Toolkit Level 2. The major types of batteries containing mercury include zinc oxide, mercuric oxide, silver oxide and some alkaline manganese batteries. Another high contribution of mercury is from general alkaline batteries. The main buyers of these various types of batteries are individuals, companies and the public at large. Mostly, used batteries are disposed with general waste and people are not aware of the negative effect of this practice to human health and the environment. Vulnerable groups particularly children have direct contact with these hazardous materials.

Batteries with mercury content imported in the country and used for the calculation in the toolkit are listed in Table 2.17. The average figure of imported batteries during 2012- 2016 and the assumption of weight for single battery to be 0.83gm are the unit item converted to tons.

### 2.8.6 Paints with Mercury Preservatives

Despite the fact that a limited amount of paints is produced in the country, the majority of paints are imported to the country (Table 2.18). However, it cannot be claimed that either type of paints is controlled for their negative impact on the environment. Leftovers of paints are mixed up with other hazardous materials, which could certainly contribute to mercury release to the environment, to the tune of 72 kg Hg/year. The amount of paints imported for marine purpose which could account for mercury releases

Table 2.15: Importation of thermometer through Department of Customs

HS CODE	DESCRIPTION	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total Avg 2012-2016
902511	Medical thermometer	item	30	472	1515	1734	33	404	235	80	50	160.4
902620	Medical blood pressure gauges (mercury sphygmomanometers)	item	4994	80	166	850	175	1108	6268	14585	704	4568
280540	Elemental mercury for any application.	0	0	0	0	0	0	0	0	0	0	0
902519	other glass Hg thermometers and engine control thermometers	item	161	2450	0	148	71	670	198	239	273	290.2

Table 2.16: Importation of light sources (Department of Customs)

HS CODE	DESCRIPTION	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total average 2012-2016
853931	Fluorescent tubes + compact fluorescent Lamps	item	9197	58028	35195	122400	82346	59131	28752	5364	5215	36161.6
853932	Other Hg containing light sources	item	413	50	4007	326	-	4192	86544	14454	6727	22383.4
853939	other Hg containing light sources	item	805	6238	9272	11394	3343	21490	9832	3345	23057	12213.4
853941	other Hg containing light sources	item	677	10	2	7676	1089	1429	25882		600	5800
853949	other Hg containing light sources	item	29	9428	1435	1394	393	3254	514	507	12	936

and emissions is roughly estimated to be 5% of the total paint imported to the country.

### 2.8.7 Skin-Lightening Creams and Soaps with Mercury

The activity rate used in the toolkit is based on the data collected from the customs office (Table 2.19). According to the HS code, the data gathered attributes only to mercury containing materials. The use of skin lightening products with mercury contributes around 30 kg Hg/year.

It is deplorable to note that consumers are not aware of the hazardousness of these materials.

### 2.8.8 Other Manometers and Gauges with Mercury, Lab. chemicals and med. equipment

The Toolkit Level 2 calculated mercury emissions of 371 kg Hg/year for manometers and gauges with mercury and 51 kg Hg/year for laboratory chemicals and other medical

Table 2.16: Importation of light sources (Department of Customs)

HS CODE	DESCRIPTION	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total average 2012-2016
850630	Mercury Oxide batteries	Item	723	-	878	3,450	90	58,010	11,766	2,622	606	14,618.8
850640	Other Button cells	Item	49,540	4,649	0	150	540	0	2,740	2,128	7,170	2,515.6
850650	Other Button cells	Item	7	3	413	79,300	355	703	3,833	1,792	41,324	9,601.4
850660	Other Button cells	Item	578	26,900	2,357	3,192	848	371,351	88,777	12,134	6,374	95,896.8
850610	other Batteries with Mercury, Average Weight is 7.6 per battery	Item	31,995	153,867	66,671	961,176	229,839	1,764,274	503,450	78,221	73,956	529,948
850680	Average Weight is 7.6 per battery	Item	31,995	153,867	66,671	961,176	229,839	1,764,274	503,450	78,221	73,956	529,948
850690	Average Weight is 7.6 per battery	kg	282	410	4,096	594	6,332	1,102	540	2,014	8,224	3,642.4

Table 2.18: Importation of paints with mercury (Department of Customs)

HS CODE	DESCRIPTION	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total average 2012-2016
381400	Paints with mercury preservatives	Kg	1399	36100	57117	100458	400641	15416	2129108	22947	186363	550895

Table 2.19: Importation of skin lightening creams and soaps

HS CODE	DESCRIPTION	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total average 2012-2016
330491	skin lightening creams and soaps with mercury chemicals	Kg	6.5	30	0	2075	260	191	54	2227	2275	1001.4

Table 2.20: Importation of skin lightening creams and soaps

Source category	Estimated Hg releases, standard estimates, Kg Hg/y						
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
<b>Waste incineration</b>							
Incineration of hazardous waste	?	?	?	?	?	?	?
Incineration / burning of medical waste	30	30	0	0	0	0	0
Open fire waste burning (on landfills and informally)	159	159	0	0	0	0	0
<b>Waste deposition/landfilling and wastewater treatment</b>							
Informal dumping of general waste	370	37	37	296	-	-	-

equipment.

## 2.9. Data and Inventory on Waste and Recycling

Waste is one of the major concerns of the country due to inadequate management systems both for liquid and solid wastes. All the towns and cities of the country collect solid wastes and dispose of them in open dumps. The industrial effluents are added to the municipal waste streams without any primary treatment and this would pose a serious threat to public health. Open burning and informal disposal of wastes which has high potential of mercury release to the environment and climate change (Table 2.20) is widely practised by communities. Regarding the recycling system in Eritrea, there are some industries for recycling plastic wastes.

## 2.10. Incineration of Municipal/General Waste

Municipal waste is generally produced by towns and cities at various levels in the country. The towns and cities generally have a rudimentary level of waste management where they, for example, designate an area for dumping the waste, generally in the surrounding outskirts. It is also deplorable to observe waste disposal sites within residential areas. No waste segregation of any sort has been observed by the study team. In most medium size towns and villages, the general wastes with its contents are incinerated by open fire. Based on the Toolkit, the total mercury emission from informal dumping sites of general waste is estimated to be 370 kg Hg/ year.

### 2.10.1 Incineration of Hazardous Waste

As explained in section 2.9, the incineration of hazardous waste takes place generally together with any general



Figure 2.7: Mendefera referral hospital, manual and electrical medical incinerators

wastes without any prior segregation.

### 2.10.2 Incineration of Medical Waste

Medical waste is generated by healthcare providers including chemical waste which have mercury products like thermometers and plastics. Most of these healthcare providers use manual incinerators for infectious medical waste, which has contact with blood. Some referral hospitals installed electrical incinerators, such as Mendefera referral hospital (Figure 2.7), though not all are function-

al now, except for at Dekemhare referral hospital. The data obtained for the calculation in the toolkit were used by selecting different healthcare providers' samples in the six Eritrean regions.

### 2.10.3 Open Fire Waste Burning (On Landfills and Informally)

This category includes mainly the burning of waste at waste dumps and informally (in streets and backyards notably). Municipal dumping sites in major cities and towns are considered as potential sources of releases of mercury and other unintentional pollution including greenhouse gases, dioxins and furans. Most of the municipal dumping



Figure 2.8: Informal open burning in Asmara

sites (cities and towns) including the capital city are closer to the residential areas and are accessible by livestock and wildlife. Various wastes including thermometers, batteries, florescent, plastics, glasses, metal scraps and medical wastes are dumped along with municipal solid waste and upon open burning lead to unintentional mercury releases. The data collected for the spread sheet comes from the municipality of populated cities and towns by using questionnaires. Figures 2.8 describes the informal burning in Asmara. As per the Toolkit Level 2, the mercury release to air from open fire waste burning amounts to 159 kg Hg/year.

### 2.10.4 Data and Inventory of Crematoria and Cemeteries

Cemeteries contribute to an estimated mercury input of 2

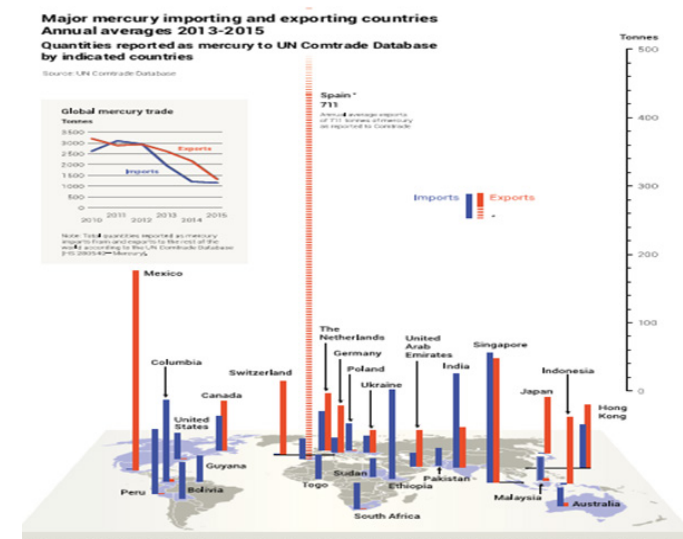


Figure 2.9: Major Mercury importing and exporting countries annual average 2013-2015



kg Hg/year. Eritrea does not culturally allow crematoria for dead bodies meaning that the country has only cemeteries. The human body contains mercury, mostly from dental amalgam, but also from the diet. This mercury is then released to the environment when human corpses are buried.

## 2.11. Data and Inventory of Mercury Stock-piles, Supply and Trade

### 2.11.1 Imports and Exports of the country of Elemental Mercury

This section presents trade data of the most active mercury trading countries from 2013 to 2015. The data used in this section are the countries' own imports and exports as reported to Comtrade (and as reported to Eurostat, in the European Union), not influenced or revised in this case by any confirming or conflicting data that may have been recorded and submitted by their trading partners as shown in Figure 2.9. Regarding Eritrea, the Department of Mines and Customs' Office did not allow any mercury element to the country for any purpose. The clandestine

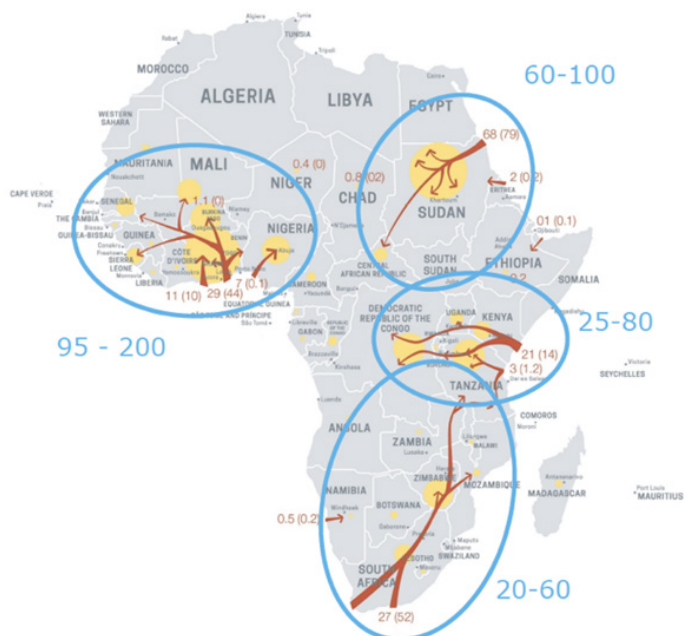


Figure 2.10: Overall trade flow of mercury in Sub-Saharan Africa.

artisanal small-scale mining practised in Gash-Barka and Northern Red-Sea regions, use smuggled mercury for gold amalgamation. The origin of such smuggled mercury is believed to be from a neighbouring country; the Sudan.

### 2.11.2 Mercury Trade

No data can be found regarding any mercury trade for any purpose in Eritrea. Eritrea does not involve itself in any

activity of stockpiling, supplying and trading of mercury.

The Figure 2.10 below, showing Eritrea as being involved in any sort of mercury trade is merely speculative and could not be substantiated within this project.

Red numbers indicate the average official import for the period 2010-2015 from countries outside the region with 2015 import figures in brackets. The actual import may be up to twice the indicated official import. The area of yellow circles indicates the estimated mercury consumption for artisanal mining in the countries (mean estimate). The blue numbers indicate the likely total mercury consumption within the sub-regions indicated by the blue circles. (Illustration from (World Bank/COWI, 2016) used with permission.)

## 2.12. Mercury Contamination and the Minamata Convention

Mercury contaminated sites are significant sources of anthropogenic mercury contamination, due to the physical properties of mercury that allow it to enter a vapour phase at room temperature and escape to the atmosphere or washed away by rain where it may be deposited in aquatic environments far from the source<sup>36</sup>.

Mercury-contaminated sites can cause serious health hazards to local communities from direct inhalation of vapour and contaminated dust, dermal exposure to ingestion of mercury-contaminated food sources. Prolonged exposure to high levels of mercury can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. High levels of methyl mercury in the bloodstream of unborn babies and young children may harm the developing nervous system<sup>37</sup>, making the child's thinking and learning ability to be slow and potentially reducing their IQ.

The Minamata Convention requires the phasing-out of many products containing mercury, implements restrictions on trade and supply of mercury and establishes a framework to reduce or eliminate emissions and releases of mercury from industrial processes and mining. The Treaty addresses various elements of mercury-contaminated sites under Article 11 (Waste) and Article 12 (Contaminated Sites).

Article 12 of the Minamata Convention on mercury states that 'each Party will endeavour to identify and assess sites contaminated by mercury and mercury compounds and the actions to reduce the risks posed by these sites will be performed in an environmentally sound manner (ESM). It is suggested that the activities that should be undertaken include:

Table 2.20: Importation of skin lightening creams and soaps

Source category	Estimated Hg releases, standard estimates, Kg Hg/y						
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
Cemeteries							
<b>Cemeteries</b>	2.00	0	0	2	0	0	0



- Site identification and characterization;
- Engaging the public;
- Human health and environmental risk assessments;
- Options for managing the risks posed by contaminated sites;
- Evaluation of benefits and costs; and
- Validation of outcomes.

In addition, parties are encouraged to develop strategies and implementing activities to identify, assess, prioritize, manage and remediate contaminated sites. The Minamata Convention is specifically focused on sites contaminated with mercury and mercury compounds, but the processes identified above can be applied to sites with any form of chemical contamination.

Under Article 12 “Contaminated sites”, the Conference of Parties are required to prepare guidance on managing contaminated sites that include methods and approaches for engaging the Public<sup>38</sup>.

### 2.12.1 Objective

The objective of this activity was to draft a strategy to identify and assess mercury-contaminated sites in Eritrea. This will enable Eritrea to establish environmentally appropriate measures to reduce the possible risks on health and the environment from mercury-contaminated sites.

### 2.12.2. Methodology

#### A. Preliminary Desk Study

Based on the information provided by the national context, mercury inventory and ASGM studies, the team has conducted preliminary desk study which includes literature review, data collection from relevant ministries, interviews with focal groups. The main results of the preliminary desk study are discussed below.

#### B. Country Mercury Inventory

Eritrea neither produces nor imports mercury legally, except the import of some mercury added products like thermometers, batteries, florescent lamps, paints. The

main mercury entry to the country is the illegal flow of mercury from neighbouring countries, especially from the Sudan, for gold amalgamation in the ASGM sector. So, it is difficult to estimate the mercury entry to Eritrea.

According to the result found from the inventory conducted, the main source of mercury emissions and releases to the environment in Eritrea are from the modern mining sector, artisanal mining activities, disposal and open burning of wastes including (municipal, hazardous and medical wastes) and manufacturing of construction materials (cement production). In addition, Table 2.21 shows the annual release of mercury to air, land and water from the given sources, derived using the UNEP toolkit.

In order to calculate mercury input from different categories to the environment within the country, the Tool-Kit Level 2 was used, as it is seen relevant to Eritrea. According to Level 2, the total mercury input to the environment in Eritrea is approximately 5816 Kg Hg/year. The first major source of mercury release to the environment is gold extraction by methods other than mercury amalgamation, to the tune of 4538 Kg Hg/year. The second anthropogenic mercury source is manometers and gauges with mercury preservatives, 371Kg Hg/year, followed by informal dumping of general waste with mercury 370Kg Hg/ year and gold extraction with mercury amalgamation from whole ore 204 Kg Hg/year. The 5th anthropogenic mercury source is open fire waste burning (on landfills and informally), 159 Kg Hg/year (Table 2.21).

#### C. Gold extraction by methods other than mercury amalgamation

Modern mining is currently being conducted in Eritrea. The Bisha Mining Share Company (BMSC) is mining its volcanogenic massive sulphide (VMS) deposit at its mine site at Bisha, producing gold and concentrates of copper and zinc. A second mining company, the Zara Mining Share Company (ZMSC) is mining a shear-hosted gold deposit at its Zara mine site. BMSC and ZMSC use only cyanidation and Carbon-In-Leach (CIL) methods for gold extraction, no mercury is in play. Due to the nature of the mining work (e.g. use of explosives, soil excava-

Table 2.21: The release of mercury to air, water and land

Source category	Estimated Hg releases, standard estimates, Kg Hg/y			
	Estimated Hg inputs (kg Hg/year)	Air	Water	Land
Primary metal production				
Gold extraction by methods other than mercury amalgamation	4538	182	91	4084
Gold extraction with mercury amalgamation from whole ore	204	157	24	22
Consumer products with intentional use of mercury				
Paints with mercury preservatives	72	66	4	0
Open fire waste burning (on landfills and informally)	159	159	0	0
Waste deposition/landfilling and wastewater treatment				
Informal dumping of general waste	370	37	37	296
Other intentional products				
Manometers and gauges with mercury	371	74	111	74

tion), mercury emissions and releases to the environment is likely high, if there are not any appropriate measures against the emissions and releases.

The companies have conducted environmental impact assessment (environmental clearance) before the start of their operation. EIA documents of each mining company are available at the DoE. In line with the national environmental regulations and guidelines, these companies are obliged to follow environmental good practices and submit monitoring and evaluation reports to the DoE periodically.

#### D. Gold extraction with mercury amalgamation

ASGM is one of the largest sources of global mercury contamination. Gold amalgamation with mercury causes widespread mercury contamination to air, water and soil as well as endangering those engaged in ASGM, their families and the illegal gold traders who supply the smuggled mercury or partially process the mercury amalgam in their shops<sup>39</sup>.

As stated above, according to the calculation using Level 2 and the ASGM investigating teams' result, the mercury emission and releases from gold extraction with mercury amalgamation is calculated as

- 204 kg Hg/year.

Most of the classical ASGM sites that existed during the Italian colonization period are abandoned at this time. The abandoned classical ASGM sites in Maekel Administrative Zone are Para-Duba, Adi Shmagle, Adi Quontsi, Mdri-Zien and Mesheal (Embaderho). In Para-Duba, Adi Shmagle, Mdri-Zien and Adi Quontsi, there were gold processing sites while Mesheal was probably used as a quarry.

Nowadays, the active traditional artisanal mining sites, where mercury is used for gold amalgamation are mainly concentrated in the gold rich quartz veins of Gash Barka Administrative Zone (Figure 2.11). Important artisanal mining sites are found in sub-zones of Molki, Shambuko, Mensura, Barentu, Mogolo, Haykota and Laelai Gash (Table 2.23).

Artisanal mining activities were at their peak from 2009 – 2014 in Eritrea, until the government of Eritrea took some measures to stop the illegal artisanal mining activities. The artisanal mining activities in Eritrea are now reduced to the minimum. Anseba, Debub and Semenawi Keih Bahri Administrative Zones have also some artisanal mining activities but mercury usage for gold amalgamation is lower. Fortunately, there are no artisanal mining sites in the Debubawi Keih Bahri Administrative Zone.

The following challenges have been identified in this artisanal gold mining sector:

- Artisanal gold mining sector in Eritrea uses mercury amalgamation to a considerable degree with very poor knowledge of mercury toxicity and very poor safety handling, no safety clothing is worn and there is little attention to the safe handling of chemicals;

- In this sector mercury enters the country illegally from neighbouring countries; it is difficult to know the amount of mercury that is smuggled to the country.
- Regulation on occupational health safety and environment for artisanal gold mining is limited;
- Inaccessibility and remoteness of artisanal mining sites led often to a weak health care system, and poor diet worsens the situation. Furthermore, food sources are potentially contaminated by the mercury used in the mining activities;
- Risks of STDs and HIV/AIDS transmission, Malaria, Dengue fever are observed;
- Concepts of health and safety at work are non-existent among the artisanal miners. Tunnels and shafts

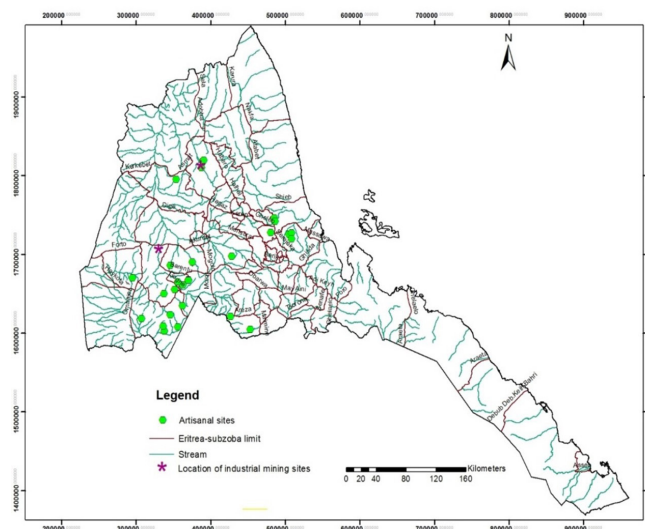


Figure 2.11: Geographic locations of important ASGM and industrial mining sites in Eritrea<sup>40</sup>

have poor ventilation. Some mining fatalities were known to have occurred, due to the collapse of tunnels and shafts that were inadequately supported;

- Deforestation of mining areas and the demand for timber for housing, fuel on the one side and often leaving behind open shafts that endanger people and animals on the other, are of great concern;
- Severe environmental consequences may happen such as soil, surface and ground water pollutions, with subsequent ecosystem damage, death of wildlife, human fatalities;
- There is no information on air quality, regarding major air pollutants, such as heavy metals, total suspended solids (mercury, lead) and acid deposition (NO<sub>x</sub>, SO<sub>x</sub>), since no scientific research and monitoring has been so far conducted in this area.

#### 2.12.3 Preliminary Field Study

In order to confirm, reverse and complete the information collected during the preliminary desk study, the team has visited Para-Duba, Adi Shmagle, Adi Quontsi, Dubarwa, and some informal dump sites. The team has inspected the sites, occasionally conducted interviews and group discussions with the local communities, took relevant

Table 2.22: Estimated Hg releases in Kg Hg/year from different categories to the environment in Eritrea (based on the Tool-kit Level 2 calculations)<sup>41</sup>

Source Category	Mercury Input, kg Hg/year
Gold extraction by methods other than mercury amalgamation	4538
Informal dumping of general waste	370
Paints with mercury preservatives	72
Gold extraction with mercury amalgamation - from concentrate	204
Open fire waste burning (e.g. on dumping site)	159
Batteries with mercury	166
Electrical switches and relays with mercury	143
Cemeteries	2
Cement production	63
Lab. Chemicals, laboratory and medical equipment with mercury	51
Biomass fired power and heat production	36
Thermometers	30
Skin lightening creams and soaps with mercury chemicals	30
Incineration and burning of medical waste	30
Dental amalgam fillings (silver fillings)	13
Other coal uses	7
Other manometers and gauges with mercury	371
Combustion/use of petroleum coke and heavy oil	2
Light sources with mercury	1
Combustion of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	2
<b>TOTAL of quantified inputs (double accounting subtracted, see notes above)</b>	<b>5816</b>

Table 2.23: ASGM sites in Eritrea where mercury was/is practiced in gold amalgamation, population in ASGM, population in gold amalgamation given by sub-zones<sup>42</sup>

Artisanal Site	ASGM site population	Subzone Estimates (extrapolation)			Population of Mercury Users
		Subzoba	Administration Zoba	ASGM population (Sub zoba)	
Mensura	1000	Mensura	Gash Barka	1000	600
Tselim Riesu	100	Lalay Gash	Gash Barka	2650	1590
Mai Kokah	250				
Shilalo-Bayo	275				
Sheshebit	450				
Antore	500				
Bartumbak	100				
Odas	350				
Dekemhare	450	Shambuko	Gash Barka	4,190	2933
Binbina-Tekinaba	240				
Cosolda2	3500				
Kona	1000	Barentu	Gash Barka	1500	300
Asheshi	500	Mogolo	Gash Barka	2000	1400
Tambera	1100				
Dega	900				
Tilega	300	Sela	Gash Barka	3400	2720
Debri-Tsaeda	700				
Elidar	2000				
Amar	400				
Shambotay	200	Haykota	Gash Barka	1200	240
Hademdemi	1000	Molki	Gash Barka	6000	3600
Ilageden	6000				
MeAldi	400				
Grat Ketin	300	Adi-Tekelezan	Anseba	700	560
Kuhli Zbi	200	Kohain	Debub	1550	0
Ketina	700				
Daero Hara	650				



Laba River	900	Shiib	Northern Red Sea	900	360
Adi Shuma	150	Ghindae	Northern Red Sea	350	245
Ayenti	200				
<b>Total</b>	<b>25,440</b>			<b>25,440</b>	<b>14,548</b>

photographs and soil samples and analysed the samples through XRF 3000. The main findings of the preliminary field study are discussed below. Based on the soil analyses made, results taken by the team and ministry of energy and mines, Para-Duba, Adi Shmagle, Adi Quontsi, Dbarwa, Zara, Augaro and Haykota ASGM sites including informal dump sites are categorized under ‘suspected mercury-contaminated sites’ by the team.

#### A. Para-Duba Abandoned ASGM Site

The Para-Duba abandoned ASGM site is located on the western outskirts of Asmara, around 4 - 5 km from the centre of Asmara (Figure 2.12). The abandoned ASGM site was owned by an Italian Investor named Alfano and mercury was used for gold amalgamation. The Italians were mining the ore from a nearby deposit and processing it in a closed building, the ruins of the building along with the demolished jaw crusher still exist (Figure 2.14b). The tailings were dumped in the open in the proximity of the



Figure 2.12: Para-Duba housing master plan which includes the Abandoned ASGM site

crusher; heaps of the tailings are still easily noticeable.

Currently, the Para-Duba area is part of the Greater Asmara Master Plan and construction of some housing complexes are already in place in close proximity to the abandoned ASGM site. Depending on the future necessary in-depth investigation and its conclusions, any housing project in area should be well thought out. The abandoned ASGM site is part of the farming and livestock grazing land (Figures 2.13 and 2.14).

Soil erosion is also another observed problem, downstream water and soil can be easily contaminated.

By virtue of its location and if contamination is confirmed, the site could pose potential high risk to the local communities, thus, urgent and appropriate action of decontamination and rehabilitation is of paramount importance.



Figure 2.13: Para-Duba, housing near the ASGM tailings

#### B. Adi Shmagle Abandoned ASGM site

Adi Shmagle village is located 8 km west of Asmara. It is a densely populated village of subsistent farmers. The topography of the area is characterized by a vast peneplain of farmland, especially towards the east of the village. On the west, the village is sparsely forested with eucalyptus trees, close to a stream that flows into a dam, a few kilometres further to the west.

Adi Shmagle's abandoned ASGM site is the most significant and classical ASGM site in Maekel Administrative Zone. It used to be a relatively bigger and complex ASGM site during the Italian colonial period, which ceased to function in 1941. The company was first owned by Azienda Minerio del Africa Orientale (AMAO) and later it was taken over by a private company, the Tringali Company.

The gold bearing rocks were mined from surrounding places like Medri-Zien, Mesheal, Adi Habteslus, Weki-Duba, and Adi Asfeda, and brought to the processing site in Adi Shmagle (Figure 2.15). The mine operation included both open pit and underground mining. It is believed that the underground shaft in Adi Shmagle went



Figure 2.14: Para-Duba a) grazing livestock around ASGM tailings b) an old part of a jaw crusher at ASGM site

down to approximately 80 m deep. The mined gold bearing rocks were mostly transported by tracks and it was also reported that cable cars were also at times used to transport the rocks from the aforementioned underground mine. The village elders confirmed that the rocks were crushed and grinded to the required grain size and then chemical (most probably mercury) was added to extract the gold. From the site observation, it is understood that the tailings of these processed rocks were discharged to



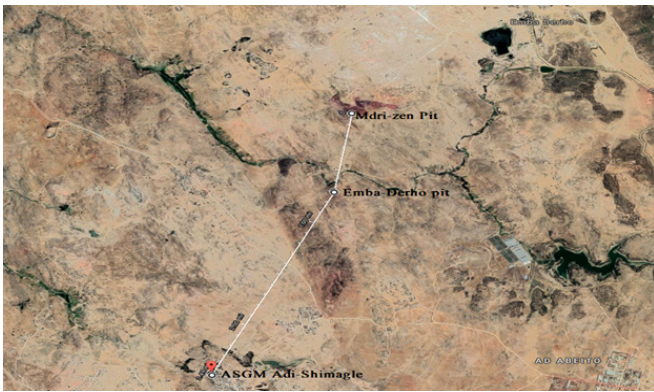


Figure 2.15: Abandoned ASGM sites at Adi-Shmagle, Emba-Derho and Mdri-Zen

the lower lying riverbeds. The residents informed that there was a large amount of accumulated waste but has since been washed away by flooding and wind over the years. Considering the high erosion potential of the area and possibly polluted stream water from the tailing to a dam in downstream at a distance of only 1.7 km could be of a serious health concern (Figures 2.16).



Figure 2.16: Dam in downstream to tailing



Figure 2.17: Adi-Shmagle, grazing on tailing site

Due to erosion and weathering, the surrounding farming and grazing areas could also be suspected of contamination and should be subject to further in-depth investigation as part of the strategy. The village has a well-functioning health clinic, providing health services to its habitants. Most of the sicknesses diagnosed are diseases like respiratory infections, diarrhea, eye infections, various injuries and musculoskeletal sickness.

### C. Adi-Quontsi Abandoned ASGM Site

Adi-Quontsi village is located 11 km west of Asmara. It is home to around 4,800 farmers; mixed farming system is practiced where crop and livestock production are integrated. Adi-Quontsi abandoned ASGM site is one among the many ASGM sites which was established during the Italian colonization around 1919. The capacity of Adi-Quontsi ASGM site looks comparatively higher than the other ASGM sites in the region. The ASGM had three mining sites named as Triangli, Tsaeda Belek and Enda America. As per the information provided by village elders, the site comprises an open pit gold mine and processing facility. The activity was carried out for over ten years intensively during the Italian colonization.

The ASGM tailing in Adi Quontsi is located within the main agricultural area and not more than 1.5 km away from a dam which is used by the community for irrigation and other agricultural activities. The potential impacts of the abandoned ASGM site to the surface and underground water might have been affected by the run-off from the tailing.

The landscape of the Zoba Maekel, located around the potential mercury contaminated sites, might have been exposed to the risk over the course of time. All the suspected contaminated sites are located in the proximity of residential and farming areas of the villages (Fig. 2.19)

Moreover, the tailings stayed in the villages for more than 80 years and about 75% of its bulk volume has been eroded and dispersed to the environment, especially to the farmlands and the nearest water bodies where the life of the majority of the people depends on. The aforementioned concerns increase the health and environment potential risk of the sites.

Although the old ASGM plants are not functional today and one observes the ruins of them only, nevertheless, they might have left a legacy of potentially contaminated areas that should be thoroughly investigated, as to find out how the deep residents' health and environment been impacted. Therefore, it is highly recommended and should be prioritized that the responsible authorities ought to take in-depth investigation and if confirmed, urgent appropriate actions of decontamination and rehabilitation of the area should be undertaken. If confirmed, a great need of launching awareness campaigns for these communities should be conducted about the risks, in accordance with the recommendations of this report. The study team observed during the discussions with the residents that the residents have no idea of the risk to which they have been and still are exposed.

### D. Dubarwa Abandoned "ASGM" Site

The town of Dubarwa is located 35 km south of Asmara. The landscape of the area comprises of rugged mountains, ridges, valleys and flat plains in between. The elevation ranges from 1800 – 2000 m above sea level. Soil formation is not deep rooted due to the topography and the erosional force of the Mereb and Gual Mereb Rivers, and their many tributaries and streams, the erosional effects on the landscape do not accommodate soil development. The topsoil is removed continuously from the general landscape .

In the true sense of the word, the Dubarwa site is not an





Figure 2.18: Adi Quontsi, shallow Pit mined by informal miners

abandoned ASGM site. It is a question of a small area with a heap of crashed waste rocks, lying at the western gate of the future Dubarwa Mining site, owned by the Asmara Mining Sh.Co, overlooking the Mereb river. This abandoned heap of crashed rocks belonged to the Nippon Company (Japan) of 1969/70, which started mining a copper deposit and forced to abandon later. The visual observation of the dissolved or suspended soil in the waste water clearly confirms the presence of problematic elements (Figure 2.20).

The above described profiles are with their limitations, but the task team is of the opinion that the profile would help in defining the priorities for future actions.

#### E. Zara ASGM Sites

Zara is found in the north-western part of Eritrea where the annual precipitation and daily temperature ranges from 100 – 200 mm and 170- 450C, respectively. The area is characterized by steep sided and ragged mountains, ridges and valleys with altitudes ranging from 500 –1900 m above sea level. The landscape is bisected by the watersheds of the Koka, Konate and Zara rivers and their tributaries, which are seasonal. Due to the mountainous landscape, the rivers and their tributaries have strong erosional power during the rainy season. The thin soil cover over the rocky surface is eroded away and deposited on the flat plains along the rivers. The occasional over flooding of the rivers would also carry large amount of soil from the plains. The Konate River flows into the Koka River, which intern flows into the Zara River. The catchment area of the Zara River is estimated to be around 977 km<sup>2</sup>. The Zara River, after flowing for around 14 km downstream, joins the Anseba River.

The main lifestyle of the local people is agro-pastoralism. Following the agro-pastoralist way of daily life, artisanal gold mining is the second alternative activity in the area during dry periods of the year. This activity attracts also people from remote locations. According to the SEIA study conducted for the Chalice Exploration Company (2010), the number of artisanal gold miners of the area increased almost 5 times in the year 2008 to 2010(appro. 4,000 – 6,000 individuals). Although no current figures are available, the artisanal mining activities are assumed to have drastically reduced, with the start and ongoing mining activity in the area by the ZMSC.

It is deplorable to note that the people use the illegally



Figure 2.19: Adi Quontsi, landscape of ASGM Site

smuggled mercury for extracting the gold and the tailing of such process are dumped on the riverbeds and banks (Figure 2.21). As the activity is informal, the people roam around through rough and impassable terrains and gorges to hide from law enforcements organs. The current artisanal mining of the area is not organized and not fixed to one particular site, it is not a classical ASGM site. The sites are found scattered over the larger Zara area.

The Zara Mining Share Company (ZMSC), the GRED-MC and the National Museum of Eritrea conducted archaeological surveys that brought to light the existence of lots of cultural resources within the area like mounds, sites or tombs.



Figure 2.20: Dubarwa, heap of waste rock close to Mereb River

A water and hydro-geologic study conducted for the area identified the Zara and the Koka valleys alluvium to be the main aquifers of the area, where the groundwater table ranges from 2.24 to 8.15 m depth. The ground waters sample analysis identified the water to be hard water. The analysis also revealed higher levels of metals like Pb, Al and Fe compared to the WHO (2006) limits .

There is one health station in Rikeb (the main town of the area) providing various medical services to the population of the surrounding area. According to the report by the national ASGM overview, the common health problems associated with the clandestine artisanal mining commu-



Figure 2.21: ASGM tailing along the Zara River bank



Figure 2.22: mercury amalgamation at Tilega, Zara area

nities in Eritrea are diverse and include musculoskeletal problems, skin disease and pulmonary problems. The Rikeb administration area is the home for approximately 506 households, where an average household is made up of 4 – 6 individuals<sup>44</sup>.

#### F. Augaro ASGM Site

Augaro is located about 55 km south west of the town of Barentu. It covers a vast plain between the Set it and Gash Rivers of Eritrea, where gold mining had been carried out before and during the Italian colonial period. Some of the artisanal mining sites are also clandestinely active at this time.

Artisanal mining activities have been going on around Augaro by the local community for longer periods of time, where the use of Hg for extracting the gold cannot be excluded. The artisanal mining activity of the area has attracted not only local people but also people from remote areas. Most of the people engaged in artisanal gold mining are peasants and semi-pastoralists, which would opt for such activities during the dry periods of the year where, traditionally, no agriculture is conducted.



Figure 2.23: Burning of the amalgam to liberate mercury in open air using spoon; (a) Amalgam before heating (b) After mercury is evapo-rated (Kerksha area near Cosolda)

According to Usoni<sup>45</sup>, in the years 1932 –1937, gold production from ASGM activities was about 295.4 kg. It climbed to higher levels of 580 kg of which 352 kg was produced by amalgamation and 228 Kg by cyanidation from 1937–1941. The tailings were simply damped on the surrounding grounds, which were exposed to weathering and erosion and carried to the nearby streams and rivers. This made the area susceptible for mercury contamination and hence the need for in-depth investigation, in accordance with recommendations suggested.

#### G. Haykota ASGM Sites

The town of Haykota is situated 306 km southwest of Asmara. The well-known gold occurrences in the Haykota area are Hadememi, Berkle, Shekay, Mereit, Chingae, and Shambotay. The gold occurrence is connected geologically to a shear zone of meta-volcanic and meta-sedimentary rocks. The actual processing and extraction of the gold by way of grinding and amalgamation takes place in Haykota<sup>46</sup>. Thus, the Haykota area needs closer investigation for its risk of Hg contamination. In the Haykota area, no classical ASGM activities are observed.

The ministry of energy and mines has additionally iden-

Table 2.24: Soil samples analyses for mercury contamination along Haykota, Augaro and Zara

Sample	Soil type	Depth (cm)	Hg (ppm)
SS4	Waste	0	6.98
SS10	Floodplain	0	0.005
SS20	Floodplain	162	0.005
SS25	Floodplain	24	0.005
SS33	Floodplain	114	0.005
SS41	Floodplain	55	0.005
SS47	Floodplain	14	0.005
SS51	Agriculture	15	1.39
SS52	Agriculture	30	1.23
SS53	Floodplain	0	0.005
SS60	Floodplain	20	0.005
SS67	Waste	0	38.7
SS69	Waste	0	38.2
SS70	Floodplain	0	6.34
SS72	Dust	0	1.69
SS74	Dust	0	14.3

45- Usoni, 1952

46- Geol. Survey of Eritrea et.al, 2000





Figure 2.24: Cosolda, vulnerability of breastfed baby during processing of ore



Figure 2.25: A child digging for gold at near surface, Kona prospect,

tified very important artisanal mining sites, in terms of population and mercury amalgamation practices, in Zoba Gash Barka in the sub-zobas of Molqi, Shambuqo, Mensura, Mogolo (Kosolda), Barentu and Laelai Gash among others<sup>47</sup>. 74 soil samples were taken at different ASGM locations along Haykota, Augaro and Zara areas by the line ministry (Table 2.24). The sampling was made from the tailing, floodplains, agricultural land, stream sediments, and dust. Out of the 74 samples taken, 8 samples were found to have Hg-levels above the WHO permissible level of 1 ppm Hg, with a maximum value of 38.7 ppm. High deviation occurred in soil samples taken from waste soils, floodplains and dust samples. As part of the future strategy, a detailed study of the area, regarding potential mercury-contamination, must be conducted. If confirmed, design and take appropriate measures of remediation.

## 2.12.4 Potential Mercury Contamination from Waste Dump sites

### A. Dump sites of General Waste

Waste disposal system in Eritrea has a poor infrastructure. Wastes are disposed everywhere unsegregated in the open air, even the collected wastes; for example, landfills are open and release mercury to the environment. Referral and community hospitals, clinics, industries, etc have poor medical waste disposal practices, as it is observed by the team tasked to deal with the inventory and contaminated sites. Thus, awareness creating campaigns are highly needed.

Waste is defined as any substance which is discarded after primary use, or anything worthless, defective and any item of no use. Waste can be generally classified into hazardous and non-hazardous material which can be in solid, liquid and gaseous forms. Hazardous wastes generally include industrial, medical, agrochemical, electronic and electric waste. Whereas most non-hazardous wastes are generated by households, commercial and service provid-

ing institutions which include leftover food, paper, plant leaves, human and animal refuse that are biodegradable and compostable. Poorly managed waste has an enormous impact on health, local and global environment and the economy<sup>48</sup>.

Solid and liquid wastes are one of the major concerns, especially for cities and towns in Eritrea. As the cities are expanding, the concern with regard to solid and liquid waste management and other environmental parameters are also increasing. Municipalities are responsible for the collection and disposal of solid and liquid wastes generated from household, commercial and industries located in major towns and cities. Hazardous wastes from the industries are kept in temporary waste storage facility within factory premises before it is taken up by the municipality and dumped along with other municipal solid and liquid wastes. According to a survey conducted in 2007, it was found out, that approx. only 50% of the generated solid wastes are collected by the municipality and the rest is dumped in informal open fields, burned or thrown into water ponds, and stream bed.

Waste generated from hospitals, health care centres, medical laboratories such as chemical wastes, pathological wastes, highly infectious wastes arising out of surgical rooms are often managed separately. As most of the health stations do not have proper incinerators the existing management practice for this purpose is often open incineration. And that is of great concern. So the issue should be properly addressed and recommended remedial actions be taken.

The existing dump sites for all major cities and towns are not properly designed and could pose health and environmental risks. So, waste dump sites of the cities and towns need in-depth investigation. Some of the waste dump sites have been visited by the investigating team. The Asmara and Keren waste dump sites are located on areas, where the polluted run-off water flows into lower lying riverbeds, causing an environmental threat to the surrounding area.

### B. Mercury added products

Mercury added products like thermometers, florescent lamps, batteries with mercury, paints, etc are among the sources of mercury releases to the environment. Based on the information provided by the customs office, there is no information about the imported mercury added prod-



Figure 2.26: Google map of Asmara dumping site (Skariko)

ucts. It is also found from the questionnaires distributed; that used thermometers, florescent lamps, batteries with mercury, paints' containers etc are discarded as ordinary waste or disposed in the general waste dumping areas; it is also observed that some of the paint containers are reused by the people for different purposes. Thus, the public needs awareness not to buy mercury added products and should dispose the waste properly. The government should also work towards banning the importation of mercury added products and establishment of waste disposal plant.

### C. Asmara Dumping Site (Skariko)

Asmara municipal solid waste (MSW) disposal site (Skariko, Italian word for garbage) shown in Figure 2.29 is an open dump spot owned and operated by the city administration. The dumping site is located about 5 km east of Asmara city centre on the Asmara-Massawa road and has been in service for more than 60 years. The composition



Fig. 2.27: Asmara dumping site

of the waste that has been dumped there, includes wastes from hospitals, slaughterhouse, domestic and hazardous industrial wastes among others.

The site is located in a formerly valley between two ridges at an elevation of 2400m above sea level (Fig. 2.30). The valley is now partially filled up with waste high up to the Asmara - Massawa road level. Surface water consolidates near the south-eastern boundary of the site and flows into and beneath the dumping site. Runoff primarily exits north of the site into the Durfo River, which merges with a river coming from Beleza to form the Mai-Adkemom River, which crosses the Durfo village and serves as a source of drinking water for the Ghinda town, some 40 km to the east<sup>50</sup>.

The geology of the area consists of low-grade metamorphic rocks of Paleozoic age. The types of rocks have low primary porosity. Consequently, the flow of ground water is controlled by the rock mass discontinuities, e.g. cracks, joints and faults<sup>51</sup>.

The lower accessible areas, including the foothill plains, consist of alluvial deposits left by the seasonal rivulets, which carry away rainwater during summer season, are good for enrichment of the aquifer. The parent material is mainly composed of alluvium and co-alluvium on the foothill plains. The Mai Adkemom aquifer is composed of unconsolidated alluvium or alluvial sediments. These

sediments are frequently found in the river and stream valleys between mountains. Alluvial sediments have high porosity and permeability, thereby increasing the risk of ground water contamination.

### 2.12.5 Mercury Contamination to Land

In 2005, a research was conducted by Sandec-Eawag University (Switzerland) in collaboration with the sanitary unit of Asmara Municipality. The research was focused on the composition of composted organic matter waste (usually used by farmers in farmland) and other wastes from the dumping site (Skariko). As heavy metals are very toxic to soil, plants, aquatic life and human health, the research was mainly designed to determine on the composition of heavy metals within the waste.

As shown in Table 2.25, LF1-LF9 indicate the number of soil samples taken directly from the dumping site and LF-10 to LF12 were taken around the dumping site and the remaining samples are the standard-limit or international Swiss and German standards

As Compared to the Swiss-German Standard limits, mercury composition in four samples taken from the dumping site show higher limit of contamination (Table 2.25).

### 2.12.6 Mercury Contamination to Water

Due to the higher elevation of the dumping site, surface runoff and leachate migrating northward could contaminate the river downstream. This river receives large amounts of pollution load because there is no leachate collecting system around the dump site. The Ghinda Dam, which supplies subsurface water to the entire population, is located on the riverbed (Mai-Adkemom), which has 60m+ thick of alluvial deposit that collects surface runoffs arising from the dump site. There are also wells in close proximity to the dump site, which draw water from the Mai Adkemom aquifer. Villages like Durfo with less population receive their water from the same river. A study conducted by a group of civil engineering students as a senior project paper (Asmara solid waste management enhancement 2016), on the areas' potable water, revealed heavy metal contamination. The analysis was made in Bisha Mining Share Company SGS laboratory.

The WHO permissible limit of mercury for drinking water is 0.001 mg Hg/l. A number of water samples taken in different season have shown concentrations of mercury higher than the safe standards (Table 2.26).

### 2.12.7 Strategy to Identify and Assess Mercury-Contaminated Waste Dump and ASGM Sites

The preliminary desk and field studies conducted by the team have come with some signs of mercury-contamination (interviews, analysed soil samples, photographs ... etc) within the waste dump and ASGM sites. Thus, the team proposes detailed soil, water, plant, air, animal and human hair/urine/blood sampling to confirm the presence/absence of mercury contamination within the suspected mercury-contaminated sites. Direct sampling of soil, water and air at suspected contaminated sites or indirect sampling of nearby food sources such as vegeta-



Heavy-metals-mg/kg TR	LF-1	LF-2	LF-3	LF-4	LF-5	LF-6	LF-7	LF-8	LF-9	LF-10	LF-11	LF12	1Swiss Limit	German Limit
Lead	293	680	720	858	570	299	890	668	754	243	772	20	120	150
Cadmium	1.9	2.9	5.9	3.9	4.3	1.9	6.8	2.1	1.4	1.5	1.0	1.0	1	1.5
Chromium	159	320	352	165	148	165	158	134	124	139	115	79	100	100
Copper	2220	1600	540	506	940	334	675	1640	378	301	85	55	100	100
Nickel	71	104	90	67	85	83	93	108	87	89	54	49	30	50
Zinc	780	1560	1180	1330	1100	1280	1180	1410	896	724	177	83	400	400
Mercury	0.4	1.1	1.4	0.8	0.8	0.5	0.7	1.5	2.1	0.2	0.1	0.1	1	1

Table 2.25: heavy metals in mg/kg of waste

No.	Sample ID	Weight (Gram)	Cd ppm	Zn ppm	Cu ppm	Pb ppm	Cr ppm	Hg ppm	P ppm
1	Down stream	0.254	0.555	682.065	204.789	651.605	88.841	0.143	2989.87
2	Core Land	0.254	0.873	1147.447	364.836	154.324	107.739	0.476	3424.66
3	Core Land	0.252	2.145	1386.49	520.259	281.372	127.585	- 0.287	5489.9
4	Core Land Composite	0.253	1.446	1133.71	400.127	199.083	118.275	- 0.211	4515.27

Table 2.26: Heavy metal Analysis result in water sample taken from dumping site and its down stream

tion, fish, eggs, milk, birds or human biological samples can provide strong indicators of the presence of contaminated sites and the migration path of pollutants leaving the sites. The sampling should be comprehensive enough to identify the nature of the contamination and describe its lateral and vertical extension. The risk to human health and the environment should be assessed and appropriate remediation or management strategy can be developed as follows. The strategy includes, among others:

1. Research and development
2. Identification and assessment of the suspected mercury-contaminated sites
3. Preparation of background history
4. Delineation of the suspected mercury-contaminated sites
5. Public awareness
6. Capacity building (human and technical)
7. Sampling (soil, water, plant, air, human and animal hair/urine/blood)
8. Safeguarding the sites
9. Decontamination of the sites
10. Evaluation

#### A. Research and development

Informed policy leads to economically feasible, environmentally sustainable and socially acceptable decisions. Nowadays, research is the base for all logical decisions; all developments are research-based. Thus, it is very important to establish a group of researchers and encourage research institutions to scientifically study the dumping and ASGM sites in Eritrea. Research papers will help in decisions for site identification, delineation, sampling, safeguarding and decontamination. Furthermore, research will help the Eritrean policy makers to decide

on the future legality and safety of the waste dump and ASGM sites in Eritrea.

#### B. Identification of mercury-contaminated waste dump and ASGM sites

Due to some difficulties of transport, the team could only manage to visit study and take soil samples from few of the potentially mercury-contaminated sites in question. Thus, all sites need be visited and investigated thoroughly so that background history can be prepared and further actions can be taken accordingly.

#### C. Preparation of background history

For each ASGM site given in Table 2.23, preparation of detailed background history is very helpful to deal with the contamination path and lateral and vertical extent of contamination and for the purpose of site delineation and sampling.

#### D. Site delineation

Delineation of suspected mercury-contaminated sites is very necessary. The drainage pattern, hydrology and hydrogeology of each suspected site should be studied; accordingly, horizontal and vertical distribution of sampling could be determined. Then, the sampling area should be delineated and geo-referenced.

#### E. Public awareness

Communities should be aware of the long-term mercury and mercury compounds risks to health and environment. Awareness can be created by meetings, trainings, education etc. including the use of mass media. The awareness raising campaign should be in any case a dynamic one to reach out all stakeholders, vulnerable groups, key sectors and actors, etc. In case of Eritrea, the local governments and the mass media (especially TV, radio, print media) should be involved effectively. Considering the inaccessibility and remoteness of the artisanal mining sites and nomadic behaviour of most of the artisanal miners, radio



programs of the Tigrigna, Tigre, Kunama, Nara, Bedawiet and Arabic languages can be effective means. Case studies on mercury-contamination from Eritrea or other countries can be good examples. Alternative job activities should be developed for the artisanal miners.

#### F. Capacity building

**Human capacity building:** Human capacity building is key for an effective accomplishment of a task. Trained staffs are the secret for a successful accomplishment. Training is highly needed for all stakeholders. Professionals are needed as very small error in sampling for mercury may lead to mercury exposure and end up with very dangerous consequences. To collect data and information, samples are taken, analysed and interpreted and if necessary further changes and adjustments are made. At the end of day, highly trained professionals are needed to change the outcomes to knowledge and wisdom.

Safety should not be compromised. Provision and use of safety equipment should be applied following standard procedures.

**Technical capacity building:** As Eritrea is one of the developing countries, it has shortages of technologies, laboratories, instruments, personal protective equipment, etc. Thus, technical capacity building should be built for effective implementation of the task.

**Procurement of Mercury Detector Instruments:** The country lacks mercury detector instruments; thus, procurement of such instruments is of paramount importance. Portable instruments with a high capacity of mercury detection in the field like the Lumex's RA-915+ Portable Mercury Analyser, Atomic Absorption Spectrometer, Thermal Decomposition Attachment RP 91C with all its accessories are very useful to detect and analyse mercury and mercury compounds in soil, water, plant, fish, air, human and animal hair/urine/blood.

**Procurement of Personal Protective Equipment (PPE):** Exposure to mercury and mercury compounds is dangerous to life. People engaged in mercury detection, site safeguarding, decontamination etc need to wear safety clothes and PPE.

#### G. Sampling

**Soil, water, plant and air sampling:** Soil, water, plant and air samples can be taken directly from a known or suspected mercury-contaminated site. However, it is also important to be aware of the exposure hazards present at such sites and hence the need for the provision of PPE to reduce risks of exposure. It is also preferable to take rather more representative pooled samples of soil from larger area than just samples from one point as hotspots may be missed and the site characterisation may be inadequate.

A sampling protocol which includes a detailed description of the sampling process is crucial. This should include a description of the sampling equipment and methods, locations of each sample (latitude and longitude coordinates using GPS), notes on appearance and odour of the sample and the rationale behind the sampling (e.g.

on a drainage line, gold washing site, etc). If grid patterns for sampling are employed, then the grid intervals should be determined using appropriate national or international standards and documents.

One technique to detect mercury contamination at a suspected contaminated site with minimal disturbance of potentially contaminated material (thereby minimising exposure) is the use of mercury 'sniffers'. The 'sniffers' are portable electronic devices that can detect elevated levels of mercury on-site in the field. Some are calibrated for mercury in soil or other solid objects and others for mercury vapour. Some devices can be adapted with additional kits to test soil, water, plant and air for mercury.

Portable 'sniffer' devices include but are not limited to:

- Metorex's X-MET 2000 Metal Master Analyser, X-Ray Fluorescence Analyser
- Milestone Inc.'s Direct Mercury Analyser (DMA-80), Thermal Decomposition Instrument
- NITON's XL-700 Series Multi-Element Analyser, X-Ray Fluorescence Analyser (XRF device)
- Lumex's RA-915+ Portable Mercury Analyser, Atomic Absorption Spectrometer, Thermal Decomposition Attachment RP 91C
- MTI, Inc.'s PDV 5000 Handheld Instrument, Anodic Stripping Voltammeter
- Olympus Delta portable X-Ray Fluorescence Analyser
- Inductive Coupled Plasma

These portable devices are particularly useful for taking rapid readings at multiple points on a given site which can assist in the location of hot spots. For detecting mercury vapour on a contaminated site, a device such as the 'Lumex' analyser can be effective.

#### H. Safeguarding

After sampling and analysing, if confirmed of being mercury-contaminated, the area should be immediately isolated, monitored and safeguarded. To know the extent of the contamination is very important; especially in studying the drainage pattern of the area, downstream contamination may affect the communities along the stream up to hundreds of Km. Thus, safeguarding may extend for hundreds of Km. Information should be communicated to all stakeholders and entry to the isolated and fenced area should be prohibited.

After safeguarding, human and environmental risk assessment should be done for further actions; the decontamination process may depend on the risk assessment. Sometimes, fenced sites can be reopened, if the risk is less and decontamination is not easy, depending on the level of diffusion and nominal contamination in a specific area.

#### I. Decontamination

Decontamination of mercury-contaminated sites is not

an easy task. It requires a lot of resources, technologies, safety equipment, transporting and various heavy-duty machines among others. Safety is also required not to further spread the contamination to the environment. If the contamination is diffused and spreads to the wider area, it would be very difficult to deal with; hot spot contaminations are easier for decontamination. Confirmed mercury-contaminated sites can be decontaminated using technologies like deep burying of soil, soil washing, soil transportation or soil containment.

#### J. Evaluation mechanism

Based on the Strategic Plan, the DoE and MLWE should play a coordination role in implementing this strategic plan. In addition, it would have also the role of organizing technical meetings, workshops for project proposal development towards formulation, implementation of the strategic plan.

In order to review the effectiveness and efficiency of the strategic plan implementation, all stakeholders shall establish first, mid and final term evaluation mechanisms. The first and mid-term evaluations should be held with active participation of all relevant stakeholders to evaluate the outputs, identify the challenges, and set a direction for further implementation.

The final term evaluation is to be the total evaluation of the achievements of the strategic plan implementation that will be organized at the end of its implementation phase. Such evaluation can be made, through convening a meeting or a workshop with participation of all stakeholders to evaluate the total achievements of the strategic plan. Key points for comparing achievements can be made, through updating such as: the trend of mercury use and release from ASGM; the level of awareness of the miners; the communal behaviour towards general waste, the institutional mechanism established for managing artisanal mining communities; as well as reviewing the achievements on the set objectives and the programs of work that are related to reduction and elimination of the use, emissions and releases of mercury in the ASGM sector.

### 2.13. Generalities on Mercury

As stated in the General Introduction of the report, mercury is a highly toxic chemical element for health and the environment. This toxicity and other properties that can have adverse effects on populations and ecosystems depend on the forms of mercury considered. In addition to this, other aspects are to be considered when dealing with exposure and contamination to mercury and mercury compounds, like (i) the concentration, (ii) the age of the exposed individual or the developmental stage of the foetus, in pregnant women (iii) the duration and frequency of exposure, and (iv) the routes of exposure and contamination (inhalation, ingestion or dermal contact).

#### 2.13.1 Properties of Mercury

Mercury exhibits several properties. Metallic mercury is bright, silvery, heavy, dense liquid that freezes at -38.9 oC

and boils at 357 oC. Mercury is the only metal that exists in a liquid form at standard temperature and pressure. It is a fair conductor of electricity when compared to other metals. Liquid mercury readily dissolves many metals such as copper, silver, gold and other alkali metals and forms alloys with these metals which are called amalgams. Mercury has higher surface tension than that of water. It is notoriously poor wetting agent. When spilled on a laboratory bench or on the floor, mercury forms tiny spherical drops which are difficult to retrieve.

#### 2.13.2 Occurrence of Mercury

Mercury occurs in various deposits of the earth. Mercury has been known since ancient times and found in Egyptian tombs of 1500 B.C. It was also known to ancient Chinese and Hindus. Mercury is a chemical element with the symbol Hg. It belongs to the transitional elements and located in the period six and group IIB in the modern periodic table. It has the atomic number of 80 and atomic mass of 200.6. It is commonly known as quicksilver and silvery d-block element.

#### 2.13.3 Sources of Mercury

The sources of mercury are so much more concentrated that the metal can be obtained readily. Although mercury is rarer than gold and platinum, it constitutes about 8x 10<sup>-6</sup> percent of earth's crust by mass. Electrochemical industry, certain fungicides, thermometers, barometers, diffusion bumps, batteries, mercury vapor lamps, mercury switches, pesticides, dental amalgam preparations, mercury cells, antifouling paint, catalyst and many other electrical apparatus and instruments are the major mercury products and sources of releases to the environment upon disposal. The Sources of mercury emission to the atmosphere are natural, anthropogenic and re-emission and are described as follows:

##### A. Natural Sources

Mercury is released from the Earth's crust by the continuous and ubiquitous natural weathering of Hg-containing rocks or by geothermal activity, or Hg emitted during episodic events such as volcanic eruptions. Over the past longer geologic years, Hg emissions from natural weathering processes can be assumed to have been fairly constant, with variations largely associated with changes in volcanic and geothermal activities. Current annual (geologic) releases to air from natural sources are estimated at around 80–600 t/y<sup>53</sup> and 300 t/y<sup>54</sup>.

##### B. Anthropogenic Sources

Mercury is also released to the atmosphere as a result of current human activities. Anthropogenic sources result in Hg emissions to the atmosphere and releases to aquatic systems. Estimates of current anthropogenic emissions to the atmosphere are around 2000 t/y. Some anthropogenic sources release Hg as a result of man's use of mineral resources as fuels and as raw materials in industrial processes, including metal production, in particular processes that involve heating materials to higher temperatures. These sources involve human activities that (intentionally

or unintentionally) release Hg from crustal rocks and/or expose rocks and ore bodies that would otherwise remain buried and inaccessible to surface weathering processes. Mercury is present as an impurity in fossil fuels (coal in particular), ores mined for ferrous and non-ferrous metal production and other minerals used in the production of materials such as cement. Although Hg is generally present in low concentrations, the considerable volumes of these materials that are extracted and used and the high temperature involved in the processes can result in substantial Hg releases to the atmosphere. Mercury, itself is produced commercially by mining and extraction of Hg ore (cinnabar), however, compared with other primary anthropogenic sources, Hg production is a minor component. Because the environmental releases of Hg associated with these activities are an artefact of the processes involved, the associated emissions are sometimes termed ‘by-product’ or ‘unintentional’ emissions. Many industrial sites such as old mines and decommissioned chlor-alkali plants exhibit high levels of local Hg contamination, and Hg emissions from these contaminated sites can continue for longer periods after operations have ceased.

A second category of anthropogenic sources are those that release Hg to the atmosphere following its intentional use. These intentional uses include Hg use in ASGM and certain industrial and chemical processes, and in general man-made products that contain Hg. These products include certain types of energy saving and fluorescent lamps, batteries, electrical devices and instruments (including Hg thermometers), paints, cosmetics, some pesticides and fungicides. Releases occur during manufacturing and following breakage and/or disposal of Hg-containing products. Associated anthropogenic sources include releases from (controlled and uncontrolled) incineration of waste, and from wastes in (contained) landfills or (uncontained) dumps, or contaminated sites. Recycling of materials, including secondary ferrous metal production, results in some Hg emissions, as does Hg use in dental amalgams where cremation or burial of human bodies results in release of Hg to the atmosphere. One of the human uses of Hg with the highest associat-

ed Hg emissions is its use for extracting gold in ASGM. Mercury emissions to the atmosphere also occur from its use in the chlor-alkali industry in Hg-cell caustic soda production. Use of Hg in the production of vinyl chloride monomer (VCM) is a potentially significant source for which emissions are still not quantified.

### C. Re-emissions

These comprise Hg releases to the atmosphere that are derived from past natural and anthropogenic releases. Under the right conditions, Hg can be (re-) emitted to the atmosphere from the Earth’s surfaces (soil, rocks, snow and ice, surface waters – including ocean surface water, and vegetation) that have previously received Hg either from atmospheric deposition or through another transport pathway. Re-emission sources tend to be diffused and are associated with ‘environmental reservoirs’ of Hg that have accumulated over time, particularly in organic surface soils and surface ocean waters. Estimates of current annual re-emissions to the atmosphere that are a legacy of historical Hg releases from both anthropogenic and natural sources are in the range of 4000–6300 t/y<sup>55</sup> (Figure 2.31).

Mercury is mostly found in combined nature and only rarely occurs in native nature. Mercury compounds are numerous. The most common ones are mercuric sulfide (HgS, vermilion which is a high-grade paint pigment), mercuric chloride (HgCl<sub>2</sub>, a violent poison), mercurous chloride (Hg<sub>2</sub>Cl<sub>2</sub>, calomel that is used in medicine) and mercury fulminate [Hg (ONC)<sub>2</sub>, useful for explosives] and it has been found that an electrical discharge causes mercury vapor to combine with neon, argon, krypton and xenon.

### 2.13.4 Mercury Compounds

The three forms of mercury commonly implicated and to be considered for Eritrea as well as their properties and impacts on health and the environment are presented below.

Elemental mercury, known also as metallic mercury, is the most volatile form of mercury likely to be released into the atmosphere and most likely to remain there longer. Once elemental mercury is emitted/released into the environment, it persists there while migrating between its various compartments and in living organisms. In the atmosphere, it is airborne by the winds as vapour or absorbed by particles. This air pollution can last from a few days to more than a year and is constantly fed by degassing and evaporation from the soil and water. In Eritrea, activities that contribute to emissions of elemental mercury include (i) gold panning where elemental mercury is present in the vapours resulting from the burning of gold-mercury amalgam (although, mercury amalgamation is banned); (ii) cement production because there is mercury in the raw materials used for clinker production; (iii) the use and disposal of products such as mercury thermometers, batteries and dental amalgams; and (iv) open burning of waste, particularly mercury-containing waste. In terms of health impacts, elemental mercury is toxic to the central

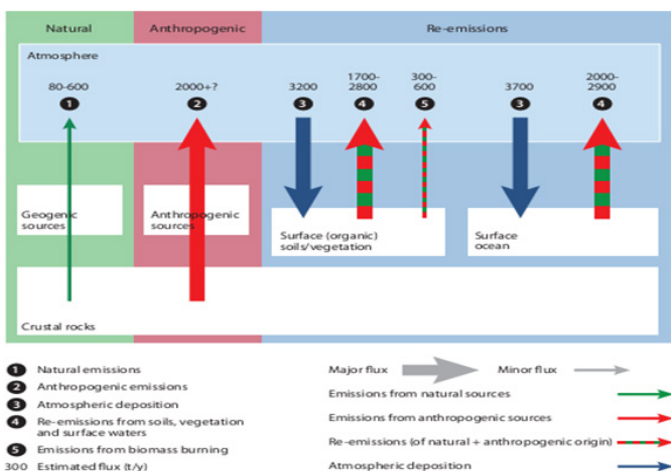


Figure 2.28: Schematic illustration of the main sources of mercury to the atmosphere showing natural, anthropogenic and re-emission components and fluxes between the atmosphere and various surface environmental compartments. Flux estimates are in t/y as derived from Mason et al. (2012)



and peripheral nervous systems. Inhalation of mercury vapour can cause adverse effects on the nervous, digestive and immune systems, lungs and kidneys, and can be fatal.

Inorganic mercury compounds, often salts, result from the combination of elemental mercury with other elements such as sulphur or oxygen. These inorganic compounds are mainly used in industrial manufacturing processes. Moreover, some products identified in Eritrea, namely lightening creams and soaps, contain variable levels of inorganic mercury. Inorganic mercury salts are corrosive to the skin, eyes and gastrointestinal tract and can induce kidney toxicity, if ingested. Also, neurological and behavioural disorders may be observed, after inhalation, ingestion or dermal application of different mercury compounds. Symptoms include tremors, insomnia, memory loss, neuromuscular dysfunction, and headache, cognitive and motor dysfunction. Mild signs of central nervous system toxicity may be observed in workers exposed to an elemental mercury concentration in air equivalent to or greater than  $20\mu\text{g}/\text{m}^3$  for several years.

Finally, there are the organic mercury compounds that are the result of the reaction between mercury and carbon. The most well-known form, also to be considered for Eritrea, is methylmercury. In soils or aquatic environments, (particularly sediments), methylation results from the transformation of elemental mercury and/or inorganic mercury under the action of micro-organisms present in these environments. Thus, in Eritrea, methylmercury can be formed in particular in the favourable environments around gold panning sites when the required conditions are met, the main factors influencing speciation and behaviour of mercury in soils being pH, organic matter concentration, redox potential, cation exchange capacity, chloride concentration, aeration, soil mineralogical composition and texture. With regard to physico-chemical properties and health aspects, once formed, methylmercury enters the food chain, particularly contaminating fish, where it has bioaccumulation and bio-magnification capacities. Thus, communities can be directly exposed by eating contaminated fish and seafood. Methylmercury bio-accumulated in fish and consumed, especially by pregnant women, can cause neurological problems in the developing foetus. Exposure of the placenta is the most dangerous because the foetal brain is very sensitive at this stage. Neurological symptoms include mental retardation, convulsions, vision and hearing loss, developmental delay, language disorders and memory loss. In children, it has been reported that a syndrome characterized by red and painful extremities called acrodynia results from chronic exposure to mercury<sup>56</sup>.

### 2.13.5 Extraction of Mercury

Mercury has been known since antiquity because it is found in concentrated ore deposits from which it is readily extracted. Mercury is obtained by heating  $\text{HgS}$  (which is the chief ore of mercury) in a current of air and followed by condensing the vapor. Spain and Italy produce 50% the world's supply of the metal.

### 2.13.6 Uses of Mercury

Mercury is widely used in the laboratory for making thermometers, barometers, diffusion bumps, batteries, mercury vapor lamps, mercury switches, pesticides, dental amalgam preparations, mercury cells, antifouling paint, catalyst and many other electrical apparatus and instruments. As it was mentioned earlier, mercury is used in glass thermometers for temperature measurement since it expands as the temperature rises.

### 2.13.7 Toxicology and Disadvantages of Mercury

Mercury is a virulent poison and is readily absorbed through the respiratory tract, the gastrointestinal tract, or through unbroken skin. It acts as cumulative poison since only small amounts of the element can be eliminated at a time by the human organism. Since mercury is a very volatile element, dangerous levels are readily attained in air. Air saturated with mercury vapor at  $20^\circ\text{C}$  contains a concentration that exceeds the toxic limit many times. The danger increases at higher temperatures. Therefore, mercury must be handled with care. Containers of mercury should be surely covered, and spillage should be avoided. If it is necessary to heat mercury and mercury compounds, it should be done in a well-ventilated hood. Methyl mercury is a dangerous pollutant and is now widely found in water and streams. Large dose of organic Hg compounds causes brain damage which is often fatal.

The recent development of instrumental methods capable of detecting metals in the part per million (ppm) or even part per billion (ppb) ranges prompted a systematic

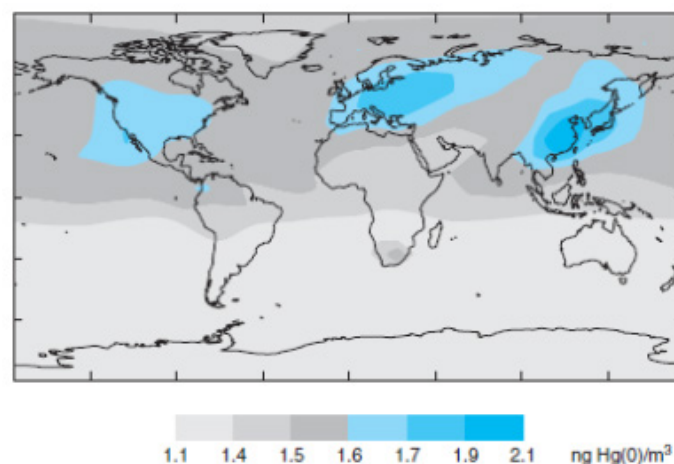


Figure 2.29: Global annual average surface concentration of Hg (Adapted from Harris *Quantitative Chemical Analysis*, 2010)

search for trace elements in water supplies and the food chains that they support. The results have been disturbing. Reported mercury concentrations in fish caught in Lake St. Clair, USA was as high as 7 ppm when compared with the safe limit set for fish by the food and drug administration of 0.5 ppm. Most of the mercury found in fish is present as an organic derivative, dimethyl mercury,  $(\text{CH}_3)_2\text{Hg}$ , a toxic substance which is known to concentrate in the food chain in much the same way as DDT. This compound is synthesized from elementary mercury



by certain anaerobic bacteria living at the bottom of lakes and rivers. Dimethyl mercury appears to concentrate in brain tissue and remain there for long periods of time. Symptoms of mercury poisoning arise when the concentration of  $(\text{CH}_3)_2\text{Hg}$  in the brain reaches 5 ppm; 12 ppm is usually fatal. Mercury is a volatile toxic pollutant. The map shows  $\text{Hg}(0)$  concentrations in the air near Earth's surface. Mercury is also found as  $\text{Hg}(\text{II})(\text{aq})$  in clouds and on particles in the atmosphere. Approximately two-thirds of atmospheric mercury comes from human activities, including coal burning, waste incineration, and  $\text{Cl}_2$  production by the chlor-alkali process. The global annual average surface concentration of Hg is given in Figure 2.32<sup>57</sup>.

### 2.13.8 Measurement of Mercury

Atomic absorption or fluorescence is a sensitive method

to measure mercury in matrices such as water, soil, and fish generates  $\text{Hg}(\text{g})$ . For most environmental samples,

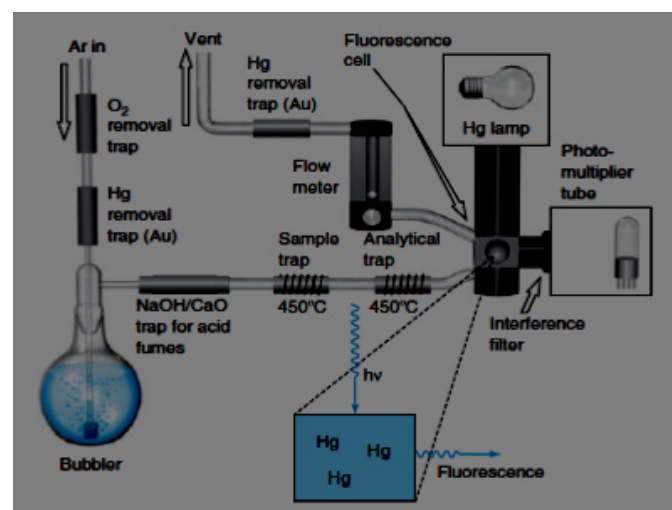


Figure 2.30: Mercury analysis by US environmental protection agency method (Adapted from Harris: Quantitative Chemical Analysis, 2010)

Table 2.27: Summary of the preliminary health and environmental assessment in Eritrea

Subject	Primary metal production (Gold Extraction by method other than mercury amalgamation and mercury amalgamation from concentrate)	Wastes (open fire waste burning, medical incineration and informal dumping of general wastes)	Cement production, Biomass for heating and cooking, skin lightening and soaps with mercury compound	Use and disposal of products with mercury content (paints, Thermometers, Light sources and electrical sources)
Source strength	This mercury source sub-category is among the five largest sources of mercury releases in the country (annual total mercury emissions/releases 4742 kg Hg/year). The BMSC and ZMSC produce gold using methods other than gold amalgamation and excavation, processing and the TMF is managed according to international standards.	This mercury source sub-category contributes moderately to mercury emissions/releases in the country (559 kg Hg/year). It contributes also to the global mercury load, and thereby to indirect exposure through foods, etc. Mercury accumulates over time in the environment with increasing risk.	This mercury source sub-category is among the smallest quantified sources of mercury emissions/releases in the country (129 kg Hg/year). Its contributions to the national and global mercury load are moderate.	This mercury source subcategory deals with materials that contain mercury. So, if improperly disposed, it contributes mercury emission/releases of 246 kg Hg/year to the environment.
Main emission/release pathways	The main direct emission pathway to the environment from these sources sub-category is via the air, water and land that is during the excavation/explosion, processing and amalgamation as indicated through the three media.	Water and land are major pathways for mercury releases to the environment from these sources.	Direct emissions and releases from these sources sub-category happen to the air, water and land.	The main releases from these mercury-added products happen during waste disposal, but releases can also occur in case of breakage or other open exposure while in use.
Exposure risk; environment	The environment within reach of the direct mercury emissions/releases from point sources of this sector/activity may severely be affected by the mercury exposure.	The environment within reach of the direct mercury emissions/releases from point sources of this sector/activity may potentially be affected by mercury exposure.	Adverse impacts of mercury exposure from this source sub-category cannot be ruled out, but any impacts are assumed as likely moderate.	The adverse impact of mercury exposure from this source sub-categories is the direct mercury emission/releases to the environment
Protected nature	The direct mercury emissions/releases from this sector/activity reaches areas which are designated as vulnerable and/or protected, and therefore environmental impacts should be avoided/ minimized as far as possible.	The direct mercury emissions/releases from this sector/activity reach areas of general character where environmental impacts should be minimized.	The direct mercury emissions/releases from this sector/activity primarily reach areas which are designated for industrial activities, where a certain environmental exposure is tolerated.	The direct mercury emissions/releases from this activity reduced by disposing at selected disposal area and promote alternative products.
Exposure risk; general population	Mercury is toxic in all its forms, ASGM sites are located in medium or less populated areas, and people may potentially be directly affected. These emissions/releases contribute significantly to local, national and global background exposure.	These sources are located close to populated areas and some settlements at downstream so the mercury emissions/releases may be spread widely. Consequently, the number of people, that are affected directly may be large. These emissions/ releases also contribute to local, national and global background exposure.	These sources are located in thinly populated areas. The number of people, that would be directly affected is moderate. These emissions/releases do however contribute to local, national and global background exposure.	Mercury-added products like these may cause direct exposure of consumers during use and disposal.

<b>Exposure risk; workers and their families</b>	Persons directly engaged in the sector/activity in question, or living within the work area, may be severely affected by mercury exposure.	People working at such areas daily are exposed to mercury releases/emissions	People working or living in proximity of these areas are exposed to mercury emissions/releases. Women, specially, using skin lightening creams unknowingly endanger themselves	persons who use the mercury-added products may be affected by mercury exposure during application and disposal
<b>Social determinants</b>	The main sociocultural factors that are in the centre of concern are ethnicity and socio-economic. Depending on the ethnical affiliation, women are not allowed to work outside in such sector; instead they participate at the amalgamation activities inside their home. So, the women and their children are highly exposed to mercury contamination. Generally, rural population depend on agriculture. If, due to certain circumstances, e.g. drought, agricultural yields are not promising, some of them look for alternative activities, e.g. artisanal mining sites. And there, they may be exposed to various communicable diseases. The affected people have generally less access to proper healthcare. The casual artisanal miners have deplorable knowledge of safety in general and on the danger of mercury exposure in particular.	The main socio-cultural factor that force people spend the day at such places is socio-economic. The type of the endangered people is those who work there for the municipalities or poor people looking for various items that can be recycled or reused in the market. The people do have access to health facility. It is safe to state the affected people don't have appropriate PPE.	The main socio-cultural factors of concern are the need of energy in household and deplorable knowledge/ awareness of women using Skin lightening cosmetics on their skin.	People who utilize the mercury-added products in various capacity, e.g. professional health worker, could be exposed when accidental breakage happens. People staying at dump sites that include medical waste are highly endangered by these items.
<b>Location or 'hotspot'</b>	The potential affected population live/work in Zoba Gash-Barka, Anseba, Semena-wi Keyh Bahri, Maekel as indicated in ASGM overview	Generally, all informal dump sites of general waste, mostly located in the vicinity of cities and towns. Some health facilities and industries incinerate their waste openly within their premises.		
<b>Priority for follow-up assessment and potentially actions</b>	This mercury source sub-category is of major potential importance and further assessment of the need for mitigation actions is recommended. The engagement/ initiatives needed to address the population at risk by MoLWE in collaboration with MoH, MoEM, MoLG, Law enforcement.	This mercury source sub-category may be of potential importance and further assessment is recommended to be taken by MoLWE in collaboration with MoH, municipalities, MoLG, Law enforcement.	Although adverse impacts of mercury exposure from this source sub-category cannot be ruled out (e.g. skin lightening) it is, however not currently prioritized for sector-specific follow-up.	
<b>Linkage with Sustainable Development Goals (SDG)</b>	Goal 3: health relevance. Goad 8: sustainable economic growth and employment. Goal 15: environmental sustainability.	Goal 3: health relevance. Goal 15: environmental sustainability.	Goal 3: health relevance. Goad 8: sustainable economic growth and employment. Goal9: provision of alternative products. Goal 12: sustainable consumption of products. Goal14: sustainable conservation of marine resources. Goal 15: environmental sustainability	Goal 3: health relevance. Goad 8: sustainable economic growth and employment. Goal 9: provision of alternative products.

automated digestion/analysis equipment is available. For water analysis using standard method, all mercury is first oxidized to Hg (II) with BrCl in the purge flask in the drawing at the right. Halogens are reduced with hydroxylamine (NH<sub>2</sub>OH), and Hg (II) is reduced to Hg (0) with SnCl<sub>2</sub>. Hg (0) is then purged from solution by bubbling purified Ar or N<sub>2</sub>. Hg(0) is collected at room temperature in the sample trap, which contains gold-coated silica sand. Hg binds to Au while other gases in the purge stream pass through. The sample trap is then heated to 45oC to release Hg(g), which is caught in the analytical trap at room temperature. Two traps are used so that all other gaseous impurities are removed prior to analysis. Hg(g) is then released from the analytical trap by heating and flows into the fluorescence cell. Fluorescence intensity strongly depends on gaseous impurities that can quench the emission from Hg. The lower limit of quantitation is 0.5 ng/L (parts per trillion). To measure such small quantities requires extraordinary care at every stage of analysis to prevent contamination. Mercury amalgam fillings in a worker's teeth can contaminate samples exposed to exhaled breath. The analysis of mercury in the environment by fluorescence is shown in Figure 2.33.

The Summary of the preliminary health and environmental impacts assessment in Eritrea is shown in table 2.27.

## 2.14. Data Gaps

Major data gaps were the following:

1. Very limited and inadequate data base system
2. It is difficult to obtain accurate statistics for some items and it is required to use some estimation methods, calculations or logical explanation to get approximate data. In addition, many statistics are accumulated from other sources and so the numbers cannot be reliably representative data.

3. Regarding imported mercury-containing products, it is difficult to distinguish mercury-containing products from other products. Thus, the determination of mercury releases from the disposal of such mercury-containing products cannot be assessed and estimated accurately.
4. The uncontrollable manufacturing, sales and import activities leads also to data gaps for all calculations. Specifically, with reference to each sub-source, we can list the data errors that may occur in Table 2.28.
5. Although Toolkit Level 2 was used for calculating the mercury releases and emissions, it does not reflect fully the actual facts in Eritrea. Its mercury to gold ratio of 1:1.3 from amalgamation after concentrate was replaced by the national ASGM team ratio of 1:1.1
6. Based on the results obtained through these inappropriate factors, one cannot make any concluding remarks, regarding the suspected contaminated sites. So, whenever necessary, in-depth investigation is recommended.

## 2.15. Implications of the inventory results for Eritrea as a Party to the Minamata Convention

Taking into account the results of the inventory, Eritrea, when becoming a Party to the Minamata Convention, will have to meet the requirements of the following Articles of the Convention (Table 2.29):

Table 2.28: The sub-source and data errors that may occur in importation.

Sub-source	Data Errors
Imports	Import figures might be available but having only statistics by groups with same product codes instead separating particular products. It, therefore, cannot be calculated domestic mercury consumption for specific manufacturing operations.
Energy and thermal energy production by using biomass	Updated data is not available. The only data that can be collected on this sub-source is of 2009. Recent data gathering from relevant institutions is underway
Gold production by amalgamation	The issues related to the manual gold production in small scale ASGM is difficult and time consuming
Gold production by other methods than amalgamation	Data related to gold production is confidential for most companies
Waste incineration and open waste burning	There are many uncontrollable open burning activities; therefore, the ratios are only indicative estimates. it lacks accuracy
Informal dumping of general waste	A common problem with waste is that it's difficult to quantify the extend of informal dumping of waste
Use and disposal of other products	Even the imported mercury added products are not well recognised and not separately documented during importation. it is difficult to quantify the products hence an estimation was made.

Table 2.29: Articles of the Convention

Article	Provisions of the Articles	Recommendations for Eritrea
<p>Article 3 Mercury supply sources and trade</p>	<p>This Article addresses mercury stockpiles at the national level.</p>	<p>Eritrea does not have any mercury stockpiles on its territory. However, the country needs to investigate further the entry of mercury into the national territory while considering the legal framework governing these imports and the ASGM activities at national level.</p>
<p>Article 4 (and Annex A) Mercury-added products</p>	<ul style="list-style-type: none"> <li>• Prohibit the manufacture, import and export of mercury-added products.</li> <li>• Annex A, Part I: To be phased out by the end of 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.</li> <li>• Annex A, Part II: Phase Down the use of Dental Amalgam by implementing 2 or more of 9 proposed measures.</li> </ul>	<p>Eritrea does not manufacture any mercury added products but has listed a number of products listed in Annex A (Part I) of the Convention, paints with mercury preservatives, batteries containing mercury, electrical switches and relays with mercury and skin lightening creams and soaps with mercury chemicals for the most important ones. The current inventory has provided the first estimates of the national situation. However, concerning these categories and the categories that have not been assessed yet, a more detailed investigation would be necessary in order to define more precisely the quantities present in the national territory in order to be able to decide on the best actions to be undertaken to prohibit the , import for these products after the date of final abandonment.</p> <p>Also, with regards to dental amalgams, this is an identified source of mercury in Eritrea. Since the use of these products is explicitly detailed in Annex A (Part II) of the Convention, Eritrea, when becoming a Party, will have to take appropriate measures to meet obligations including the elimination of dental amalgams. Similarly, all other mercury-containing medical products and devices used in public hospitals, private clinics, and other practices will need to be the subject of an appropriate strategy to ensure their replacement.</p>
<p>Article 7 Artisanal and Small-scale Gold Mining</p>	<ul style="list-style-type: none"> <li>• Reduce, and where feasible, eliminate the use of mercury and mercury compounds in the emissions and releases to the environment of mercury form, such as mining and processing;</li> <li>• Each Party shall notify the Secretariat if at any time the Party determines that artisanal and small-scale gold mining and processing in its territory is more than insignificant. If it so determines the Party shall: (a) Develop and implement a National Action Plan in accordance with Annex C;</li> <li>• Parties may cooperate with each other and with relevant intergovernmental organizations and other entities, as appropriate, to achieve the objectives of this Articles. Such cooperation may include: (a)Development of strategies to prevent the diversion of mercury or mercury compounds for use in ASGM and processing; (b) Education, outreach and capacity-building initiatives; (c) Promotion of research into sustainable non-mercury alternative practices; (d) Provision of technical and financial assistance; e Partnerships to assist in the implementation of their commitments under this Article; and (f) Use of existing information exchange mechanisms to promote knowledge, best environmental practices and alternative techniques that are environmentally, technically, socially and economically viable.</li> </ul>	<p>Gold mining has been identified as one of the major sources of mercury inputs, emissions and discharges in Eritrea. For this reason, the country has informed the Minamata Secretariat that there are more than insignificant sources of gold panning on its territory and is currently developing a National Action Plan (NAP) as part of the same project as the MIA. Moreover, the results of the NAP will be useful to the MIA and will be closely consulted during the implementation of the Minamata Convention, particularly in the context of measures to reduce and, if possible, eliminate the use of mercury and mercury compounds for gold amalgamation and for the formalization of the sector.</p>
<p>Article 8 and 9 Emissions and releases</p>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Require the use of BAT/BEP for any new sources, no later than 5 years after entry into force.</li> <li>• Develop and maintain an inventory of emissions from relevant sources.</li> <li>• Point sources are defined in Annex D of the Convention as: Coal-fired power plants; coal-fired industrial boilers; Smelting and roasting processes used in the production of non-ferrous metals (lead, zinc, copper, industrial gold); Waste incineration facilities; Cement clinker production facilities.</li> <li>• 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.</li> <li>• 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.</li> </ul>	<p>The national inventory identified various sources of emissions to the atmosphere and releases to water and soil, namely ASGM activities, incineration and opens burning of medical waste and open fire waste burning on landfills and informally among others. These articles are relevant to Eritrea, which needs to put in place measures to control and reduce the emissions and releases of mercury and mercury into the environment. Along with the actions taken, Best Available Techniques and Best Environmental Techniques should be favoured “as soon as practicable” within the five years following the entry into force of the Convention as well as the inclusion of the measures taken into existing national plans.</p>
<p>Article 10 Environmentally sound interim storage of mercury other than waste mercury</p>	<ul style="list-style-type: none"> <li>• Interim storage of mercury and mercury compounds (as defined in Article 3 that do not fall within the meaning of the definition of mercury wastes set out in Article 11);</li> <li>• Take measures to ensure that the interim storage of such 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 paragraph 3;</li> <li>• Parties shall cooperate, as appropriate, with each other and with relevant intergovernmental organizations and other entities, to enhance capacity-building for the environmentally sound interim storage of such mercury and mercury compounds.</li> </ul>	<p>The national mercury inventory hasn't identified any interim storage of mercury and/or mercury compounds. However, due to the different activities and mercury-containing products identified in the country, this article could be relevant for the country. If further studies identify this practice at national level, Eritrea, in becoming a Party to the Minamata Convention, shall promote a sound interim storage technique environmentally friendly while following existing guidelines especially those developed in the framework of the Basel Convention.</p>
<p>Article 11 Mercury wastes</p>	<p>Each Party shall take appropriate measures so that mercury waste is:</p> <ul style="list-style-type: none"> <li>• Managed in an environmentally sound manner, taking into account the guidelines developed under the Basel Convention and in accordance with requirements of the Conference of the Parties to the Minamata Convention;</li> <li>• 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);</li> <li>• 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</li> </ul>	<p>Informal dumping of general waste, open fire waste burning on landfills and informally and incineration and open burning of medical waste are among the most important sources of mercury and mercury compounds in Eritrea. As such, this article is clearly relevant for the country. While addressing this issue, Eritrea should rely on the guidance provided under the Basel Convention and be in line with its requirements as well. The adopted measures for managing waste in general but especially (under the Minamata Convention) waste “consisting of mercury or mercury compounds<sup>58</sup>, containing mercury or mercury compounds and/or contaminated with mercury or mercury compounds (including recycling, recovering and disposal) should be environmentally sustainable<sup>59</sup>.”</p>



<p>Article 12 Contaminated sites</p>	<p>Each party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds.</p>	<p>Due the presence of activities such as ASGM, open fire waste burning on landfills and informally in the country, Article 12 on contaminated sites is relevant for Eritrea. Indeed, mining sites as well as any area where mercury could be used, stocked or disposed of are potentially contaminated sites. After having identified contaminated sites at national level, Eritrea should take environmentally friendly measures to reduce the risks of such sites on human health and the environment while following any guidance that will be adopted and available on the matter and “cooperating in developing strategies and implementing activities for assessing, prioritizing, managing and, as appropriate, remediating contaminated sites .</p>
<p>Articles 16 Health aspects</p>	<p>Parties encouraged to</p> <ul style="list-style-type: none"> <li>• Promote the development and implementation of strategies and Programs to identify and protect populations at risks;</li> <li>• Develop and implement science-based educational and preventive Programs on occupational exposure;</li> <li>• Promote appropriate health-care services for prevention, treatment and care;</li> <li>• Strengthen institutional and health professional capacities for prevention, diagnosis, treatment and monitoring.</li> </ul>	<p>The existence of the categories and sub-categories of sources identified in Eritrea implies taking into consideration health aspects. As such, Eritrea should take measures to prevent the exposure and contamination of populations at risks, including adopting science-based health guidelines, education and preventive Programs on mercury issues, especially its impacts on health and putting in place appropriate health-care services for populations concerned by mercury and mercury compounds contamination.</p>
<p>Articles 17 Information exchange</p>	<p>Each Party shall facilitate the exchange of:</p> <ul style="list-style-type: none"> <li>• Scientific, technical, economic and legal information concerning mercury compounds, including toxicological, ecotoxicological and safety information;</li> <li>• Information on the reduction or elimination of the production, use, trade, emissions and releases of mercury and mercury compounds;</li> <li>• Information on technically and economically viable alternatives to: (i) mercury-added products; (ii) manufacturing processes in which mercury or mercury compounds are used and (iii) activities and processes that emit or release mercury or mercury compounds;</li> <li>• Epidemiological information concerning health impacts associated with exposure to mercury and mercury compounds, in close cooperation with WHO and other relevant organizations, as appropriated.</li> </ul>	<p>These articles are relevant to each Party willing to comply with the requirements of the Minamata Convention. Therefore, Eritrea, in becoming a Party to the Convention, will need to put in place and facilitate: (i) information exchange, including scientific, technical, economic and legal information on mercury and mercury compounds; (ii) awareness, education and public information notably on the impacts of mercury and mercury compounds on health and the environment and existing alternatives to the chemical element and (iii) promote research, development and monitoring of any tool, technique and methodology relevant for the aspects tackled by the Convention.</p>
<p>Article 18 Public information, awareness and education</p>	<p>Each Party to promote and facilitate:</p> <ul style="list-style-type: none"> <li>• 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;</li> <li>• Education, training and public awareness related to the effects of exposure to mercury and mercury compounds;</li> </ul> <p>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.</p>	<p>These articles are relevant to each Party willing to comply with the requirements of the Minamata Convention. Therefore, Eritrea, in becoming a Party to the Convention, will need to put in place and facilitate: (i) information exchange, including scientific, technical, economic and legal information on mercury and mercury compounds; (ii) awareness, education and public information notably on the impacts of mercury and mercury compounds on health and the environment and existing alternatives to the chemical element and (iii) promote research, development and monitoring of any tool, technique and methodology relevant for the aspects tackled by the Convention.</p>
<p>Article 19 Research, development and monitoring</p>	<p>Parties to cooperate to develop and improve</p> <ul style="list-style-type: none"> <li>• Inventories of use, consumption and anthropogenic emissions and releases;</li> <li>• Modelling and geographically representative monitoring of mercury in human and environmental media;</li> <li>• Assessment of impacts;</li> <li>• Harmonised methodologies;</li> <li>• Information on the environmental cycle, transport, transformation and fate of mercury.</li> </ul>	<p>These articles are relevant to each Party willing to comply with the requirements of the Minamata Convention. Therefore, Eritrea, in becoming a Party to the Convention, will need to put in place and facilitate: (i) information exchange, including scientific, technical, economic and legal information on mercury and mercury compounds; (ii) awareness, education and public information notably on the impacts of mercury and mercury compounds on health and the environment and existing alternatives to the chemical element and (iii) promote research, development and monitoring of any tool, technique and methodology relevant for the aspects tackled by the Convention.</p>

# 3. IDENTIFICATION OF POPULATIONS AT RISKS AND GENDER DIMENSIONS

## 3.1 Populations at Risks

The population potentially exposed to mercury contamination is those who work in large and artisanal small-scale mining, waste management activities including mercury added products and communities dwelling around these areas. Moreover, people dwelling around the ASGM sites that have been abandoned for so long could also be potentially at risk to the residual effects of mercury.

### 3.1.1 Workers from ASGM Sites

Although artisanal gold mining activities are poverty driven, exposure is likely among those who use mercury amalgamation for gold extraction. Mercury use for amalgamation in the artisanal mining is prohibited and people tend to use behind doors and sometimes at home. The annual mercury input from this sector (illegal) reaches about 204 kg exposures to mercury is more serious when mercury is added to the ore and when it is heated to liberate gold. The process is usually done by people with very limited awareness about the health impacts of mercury exposure. Women, children, and the elderly could be at risk.

### 3.1.2 Women and Children

In some societies, women are mainly involved at the less labour-intensive part of the artisanal mining such as in the panning of gold and smelting. The excavation and digging work, due to the need of physical efforts and hardship are mostly done by the men. The division of labour make women the most vulnerable to mercury contamination. The exposure gets worse when the panning and the smelting are done in a confined area, particularly at home where children and small kids could also be exposed.

### 3.1.3 Workers in Cement Production Plants

The Ghedem Cement Factory uses coal combustion to produce cement from its coral limestone. The Massawa Cement Factory on the other hand, uses heavy oil to produce its cement. Both plants use the same raw material, the coral limestone, for the cement production. Mercury is released from the raw material during processing and from combustion of coal. The study has revealed that the annual emission of mercury from the cement factory is minimal, yet workers who are engaged in the production, processing, packaging, loading and unloading are vulnerable to mercury exposure. Exposure could be worse when the awareness level is limited and a proper safety procedure is not adhered, such as wearing appropriate protecting equipment.

### 3.1.4 Waste Management workers and other groups

The inventory confirmed that waste is among the sources of significant emission/releases of mercury. People engaged in the collection, transportation, storage and dis-

posal of waste are potentially at risk. The annual mercury emission/release from open fire waste burning and informal dumping of waste reaches as high as 559 Kg and most inputs go to air. The emission from this sector primarily endangers the labourers and communities that are in close proximity where the activity takes place. Moreover, people dwelling downstream of any point source (e.g. Asmara waste disposal site) are vulnerable to the release of mercury through run off and leachates.

### 3.1.5 Healthcare Workers, Including Dentists and Scientists Working in Labs

Healthcare workers, including dentists, medical doctors and technicians working in labs, could be exposed to the risk of mercury during breakage of products containing mercury. The inventory report revealed that the total mercury input from dental amalgam, medical mercury thermometer, and other medical equipment account for about 435 Kg annually. The knowledge about the hazard associated with mercury and mercury containing products better understood by most professionals and exposure is assumed to be minimal. However, labourers like cleaners, are vulnerable to the risk of exposure during collection of safeguarding of the broken medical equipment containing mercury. Although incineration of medical waste is practiced, its effectiveness is a concern and hence workers and people living in nearby the incineration site are likely to be vulnerable to the mercury emission. Further investigation on the risk of exposure to mercury emissions from this sector is of paramount importance.

### 3.1.6 The General Public

In most Eritrean households, biomass and charcoal is used for cooking and heating purposes. The emission of mercury from burning of biomass accounts for 36 Kg annually. People who are engaged in cooking at household, particularly women and their small children and elder people who spend most of their time at home are the most vulnerable to the risk. However, the annual contribution from this source is very small and risk of the exposure is also minimal.

### 3.1.7 Gender Dimension

Exposure to mercury during the amalgamation process poses one of the greatest health threats to women working in artisanal gold mining. While mercury exposure is dangerous for women and men, socio-cultural factors often lead to greater exposure for women and women in child-bearing years can cause more severe physical harm from such exposure to the foetus in the future. In Eritrea, mercury amalgamation and amalgam decomposition are often carried out by women, men and children putting them in direct contact with mercury. Most of the activities/processes were done close to rivers/mining sites

and some of the processing takes place in houses. Direct open-air burning to separate gold from the amalgam may also take place in houses or under small sheds near the mining sites, leading to high exposure to mercury vapours in these enclosed spaces. The separation of gold from the amalgam is mainly carried out by women. They do this using normal cooking methods and often separation is conducted while carrying a baby. In some places, women are the predominant food providers and are frequently exposed. Additionally, since women are usually responsible for caring for young children and babies, their participation in mining activities is often done with babies tied to their backs or toddlers at their sides, exposing their children to the same health hazards. While awareness of the risks associated with mercury is scarce among all miners, socio cultural inequities particularly hinder access to information for women, often leaving them unaware of the risks they and their children face with repeated mercury exposure.

# 4. POLICY, REGULATORY AND INSTITUTIONAL FRAMEWORK ASSESSMENT

The law-making process in Eritrea is facilitated through the Ministry of Justice, Department of Legal Services, which acts as the main government body for the drafting of laws, is responsible for the last procedure for validating and proclaiming the laws. The Ministry of Justice is the judicial organ which reviews and aligns draft laws initiated by the administrative ministry or body and presents the final draft to the Cabinet of Ministers or Office of the President, as the case may be, for final approval and promulgation. When it comes to ratification of international treaty, the concerned government body initiates the ratification process which includes a thorough study and review of the treaty's importance and the need for Eritrea to become a party to such treaty and presents this study as well its recommendations to the executive branch of the government for approval and undertaking meaningful steps in adopting such treaties through the Ministry of Foreign Affairs and then domesticating this treaty through the administrative ministry and the Ministry of Justice.

Article 10 of the constitution mandates “the State shall work to bring about a balanced and sustainable development ... [and]... have the responsibility to regulate all land, water and natural resources and to ensure their management in a balanced and sustainable manner...; and to create the right conditions for securing the participation of the people to safeguard the environment”.

Therefore, even though the Constitution has not yet entered into force, the ratified Constitution of Eritrea serves as a roadmap and orients the protection of the environment based on the constitutional principles of sustainable development, effective management, and public participation. In particular, it has a general influence on the protection of the environment.

## 4.1 Review of Existing Policies, Laws and Regulations on Management of Mercury

As part of the team's analysis and review of the pertinent policies and legal instruments governing the institutions that are envisaged as the stakeholders for the sound management of Mercury, the following policy and regulatory instruments have been gathered and analysed.

## 4.2 Environmental Policy, Law and Regulations

### A. The Macro-Policy of November 1994

This policy document is the first of its kind in post-independent Eritrea that deals generally with economic, social, cultural and environmental issues at Macro level guiding the national development in the years 1994-1998. The Government of the State of Eritrea in its Macro-policy iterated that one of the principal national development objectives is to ensure “an upgraded and safe-guarded environment that is free from pollution”. The importance of

this policy document for our purpose is that it specifically sets up a general principle in promoting an environment free from pollution whatever is the source of such pollution, of course, including pollution from heavy metals such as mercury.

### B. The National Development Policy

The Eritrean economy is guided by the resolutions reached by the Cabinet of Ministers of the State of Eritrea and Eritrean Macro-Economic Policy. These, together with the national legislation and international agreements, provide an overall framework for the strategic development of Eritrea. At the same time, the Eritrean Macro-Economic Policy helps to determine the priorities that have to be considered in the actions that the country embarks upon.

The National Development Plan of the State of Eritrea has been revised and substituted by the National Economic Policy Framework and Program (NEPFAP) covering the period from 1998-2000. NEPFAP provides a framework for implementation of the Macro-Policy Statement of November 1994 and provides many statements which influence sustainable utilization and development of the environment.

Environmental policy and sustainable utilization of resources must be in harmony with the overall development policy. The NEPFAP itself contains many environmental policy oriented strong statements; the most highly important of them is protecting, restoring and enhancing the environment through:

- Prudent utilization of land, forest, air, and water resources;
- Establishment of sound environmental standards;
- Introduction of sustainable land management practices;
- Adoption and implementation of a comprehensive national development policy framework;
- Sustainable exploitation of Eritrea's fishery resources; and
- Monitoring and protection of Eritrea's Red Sea coastline.

Another important development policy document is the ‘Strategic Partnership Cooperation Framework (SPCF) 2013-2016: Government of the State of Eritrea (GoE) - United Nations (UN)’ developed in 2013. The SPCF is guided by the Millennium Development Goals (MDGs), various international goals and commitments, and guidance on national development priorities by the Ministry of National Development. One of the five strategic areas of the SPCF as guided by GoE's expressed priorities is Environmental Sustainability. This being the latest policy



framework, the strategic priority four is environmental sustainability. Based on this priority, the SPCF Outcome 7 is that ‘Eritrea is on track towards the achievement of MDG targets for environmental sustainability’<sup>60</sup>.

However, generally, there is no specific and/or integral law in place to address the management of chemicals including mercury.

### C. Environmental Law

The Ministry of Land, Water and Environment (MoLWE) in general, and the DoE, in particular, is the organ of the Ministry mainly entrusted with the protection, promotion and management of the environment. The only and latest legislation that deals with the protection, management and rehabilitation of the environment are: (i) The Eritrean Environmental Protection, Management and Rehabilitation Framework Proclamation No. 179/2017<sup>61</sup>; (hereafter the Proclamation); and (ii) Environmental Protection and Management Regulations- Legal Notice No. 127/2017<sup>62</sup> (hereafter the Regulation).

The Proclamation is the main legislative framework for the protection and management of the environment so far. It provides a comprehensive legal context for the proper management of the environment including pollution of mercury. It is not only the latest policy and legislation on the environment but also the only piece of policy and legislation that address this subject matter in its entirety.

In its preamble, it states that, ‘proper protection and management of the environment and sound use of natural resources is a fundamental dimension of the process of sustainable development; and, environmental awareness and community involvement is critical for the effective protection and sustainable management and rehabilitation of the environment.’

Article 4 provides for the objectives, that is, this legislation establishes the foundation of environmental management and protection laws and for their implementation and enforcement; advances an environmental policy framework consistent with sustainable development; guarantees and promotes maximum public and community participation in the conservation, protection and enhancement of the environment; and, sets up the basis for Eritrea’s effective international cooperation. Moreover, Article 5 of the same legislation establishes and states the principles of environmental management: integrated management approach; streamlining environmental protection into sustainable development planning; human wellbeing; fairness and equity; environmental rights and duties of persons; sustainable use of natural resources; polluter pays; public participation and international obligations. These principles together impact the overall effective and efficient protection of the environment including the national infrastructure, capacity and legal framework for the management of mercury.

Article 11 of the Proclamation which provides for the establishment of an environment unit in line ministries to carry out some functions and duties as assigned is of a particular interest to this assessment. Articles 12 and 13 of the Proclamation emphasise on the fact that environmental protection and management is a cross cutting issue and therefore it needs maximum cooperation and coordination between all stakeholders. As a result, there is a need for the establishment of the National Environmental Council (NEC) composed of Director Generals of the following ministries: Ministry of Agriculture, Ministry of Health, Ministry of Energy and Mines, Ministry of Land, Water and Environment, Ministry of Marine Resources, Ministry of Public Works, Ministry of Trade and Industry, and Ministry of Transport and Communications. Article 14 provides that the Council (NEC) has obligations, in particular interest, to ‘promote coordination and co-operation among line ministries in environmental protection Programs and ensure the harmonization of environmental plans and policies of the various sectors.’

The MoLWE, in general, and the DoE in particular, shall use the following basic environmental management tools that are provided under Articles 17-26 of the Proclamation to assist them in implementing the provisions of the environmental legislation: national environmental management plan; environmental plan of action; environmental permit; environmental impact assessment (EIA)/project brief; environmental audit; early warning and disaster preparedness; national environmental fund (NEF); environmental information and public awareness; research on the maintenance of Eco-system integrity; and environmental quality criteria and standards. The Proclamation provides pollution control and waste management principles. Articles 31 and 32 of the same Proclamation provide for the prohibition of pollution in the sense that, ‘every person has the duty to prevent or control pollution,’ in particular ‘control of hazardous and toxic substances and their importation or exportation including mercury’. Similarly, the law in its Articles 33 and 34 impose a duty on every person to manage and minimize waste including the prohibition of import/export of waste.

The Regulation provides for the implementation of Proclamation 179/2017. In particular, procedures of application for environmental permit<sup>63</sup>; National Environmental Assessment Procedures and Guidelines (NEAPG)<sup>64</sup>; evaluation of environmental impact assessment<sup>65</sup>; environmental permit<sup>66</sup>; environmental monitoring and inspection<sup>67</sup>; and together Articles 11, 12, 13 and 14 establish efficient waste management systems and safe dumping sites; regulation of effluents and emissions; regulation of radioactive substances; and management and handling of hazardous wastes including mercury. Moreover, in a related context, Legal Notice No. 99/2004<sup>68</sup> further protects and promotes the well-being of the environment by prohibiting pollution from the use of plastic bags which may contain mercury.

60- The Strategic Partnership Cooperation Framework (SPCF) Between the Government of Eritrea and the United Nations, 2013-2016, “Driving towards MDGs”, January 2013, pages 3 and 19.

61- Proclamation No. 179/2017- The Eritrean Environmental Protection, Management and Rehabilitation Framework, issued in Asmara, January 26, 2017, Vol. 25/2017, No.2.

62- Legal Notice No. 127/2017- Environmental Protection and Management Regulations, with the same publishing information.

63- Article 3 of Legal Notice No. 127/2017.

64- Article 4 of Legal Notice No. 127/2017.

65- Article 5 of Legal Notice No. 127/2017.

66- Article 8 of Legal Notice No. 127/2017.

67- Article 9 of Legal Notice No. 127/2017.

68- A Regulation to Amend the Production, Importation, Sale or Distribution of Thin Plastic Bags Prohibition in Eritrea, published in the Eritrean Gazette of Laws, Vol. 13/2004, No. 8, Asmara, September 17, 2004.

69- Proclamation No. 58/1994, issued by the Gazette of Eritrean Laws in 1994 and which is also known as “A Proclamation to Reform the Land Tenure System in Eritrea, To Determine the Manner of Expropriating Land for Development Purposes and National Reconstruction, and to Determine the Powers and Duties of the Land Commission.”

## D. Land and Water Policy, Law and Regulation

The most important legislation related to land is the Land Proclamation<sup>69</sup> which states that, ‘all land in Eritrea is the ownership of the State. Individuals only enjoy usufruct rights.’ This legislation empowers the Government to potentially utilize the land in ways which could have positive impact on the environment. However, one of the issues of this proclamation is that it does not deal directly with the issue of environmental land pollution and protection, in particular, mercury management.

Regarding the water sector, the Eritrean Water Proclamation<sup>70</sup> under Article 3 provides for the objective of “ensuring that the water resources of the country are utilized in a sustainable manner [...] through conservation and protection from pollution and related risk factors of the country’s water resources; [...] promotion of public awareness and participation in water conservation, protection and management [...]”.

This Proclamation also provides that “The Ministry of Land, Water and Environment (MoLWE) shall not grant permit without prior submission of environmental impact assessment.”<sup>71</sup> and obliges “the Minister [to] ensure and monitor the implementation of the water proclamation, in particular, [to] ensure that the desired water quality standard is maintained and all water-related bodies and structures receive due protection against pollution, contamination and physical damage.”<sup>72</sup> This proclamation provides for the protection of water resources against direct or indirect pollution and abatement<sup>73</sup>. Furthermore, the Minister shall, in consultation with pertinent authorities, set standards and prescribe guidelines for water quality, including potable water, irrigational, industrial and other different uses of water, water desalination and water supply service suppliers.

## E. Energy and Mining Policy, Law and Regulation

The Proclamation No. 68/1995<sup>74</sup> is the relevant legislation that provides the powers, responsibilities and functions of the MoEM with respect to the mining sector. Concerning ASGM, the Proclamation has set some requirements of mining rights under Article 4 which states that, “[...] No person may prospect, explore or mine unless he is the holder of a granted license”. As to the conduct of mining operations, Article 24 of the same posits that: “The licensee [has to] promptly commence and carryout mining operations in a prudent, diligent and efficient manner, in accordance with appropriate technology and good practices generally accepted in the international mining industry;” as well as “conduct mining operations in such a manner as to ensure the health and safety of his agents, employees and other persons, and to minimize damage or pollution to the environment.”

This proclamation, in association with its Legal Notice<sup>75</sup>, provides the framework for the development of both commercial and artisanal mining in Eritrea. These legislations provide for some general requirements for environmental management and protection which, if effectively implemented and enforced, would ensure that mining operations do not result in unnecessary negative impacts on the environment. This could be evidenced from the rule provided under Article 30(6) of the Regulation which states that “The holder of an artisanal mining license shall take all environmental protection measures commensurate to his operations: in particular, he ... shall not be allowed to use mercury or similar materials in his operation.” A good example of such obligation is the corporate responsibility that Eritrean National Mining Corporation (ENAMCO)<sup>76</sup> has in relation to mining operations, that is, “ENAMCO shall comply with the relevant laws of Eritrea pertinent to mining operations, environmental protection and labour safety”<sup>77</sup>.

Proclamation No. 40/1993<sup>78</sup> (hereafter the Petroleum Proclamation) and Legal Notice No. 24/1995<sup>79</sup> (hereafter the Petroleum Regulation) are the governing legal documents in relation with the petroleum industry. Particularly, the Petroleum Regulation lays down the framework for development of the petroleum industry in Eritrea; and environmental protection is covered comprehensively under Article 11 of the Petroleum Proclamation. This legislation has the potential to provide strong protection of the environment if it is effectively and efficiently put into force.

Legal Notice No. 45/2000<sup>80</sup> which was issued by the Minister of the MoEM pursuant to the powers vested in him under Article 7(1) of the Revised Petroleum Operations Proclamation No. 108/2000<sup>81</sup> defines “Environmental Damage” [as to mean], inter alia, [...] pollution of groundwater, pollution of surface water, land or sea contamination, air pollution [...]”. With regard to the operating standards that contractors of petroleum operations have to follow the legislation, under Article 16, states that “[they] shall conduct petroleum operations in accordance with generally accepted international petroleum industry standards and practices and in a manner which is compatible with [...] the protection of human life, property and the environment.”

## F. Agricultural Policy, Law and Regulation

The Ministry of Agriculture’s (MoA) mandate in this sector is to be represented by the following legislation:

- Legal Notice No. 114/2016<sup>82</sup>

With respect to the importation of pesticides, the Proclamation, under Article 4, provides that, “The Ministry of Agriculture, before deciding on the issue of pesticide importation, [has to] consult and consider the views of concerned government institutions such as the Ministry of Health and the Ministry of Land, Water and Environ-

70- Proclamation No. 162/2010, issued by the Gazette of Eritrean Laws, Vol. 18/2010, No. 1, Asmara, August 23, 2010.

71- Article 8 of Proclamation No. 162/2010.

72- Article 10 of Proclamation No. 162/2010.

73- Articles 14 and 15 of Proclamation No. 162/2010.

74- A Proclamation to Promote the Development of Mineral Resources, issued by the Gazette of Eritrean Laws, Vol. 5/1995, No. 2, Asmara, March 20, 1995.

75- Legal Notice No. 19/1995 – also known as “A Legal Notice to Regulate Mining Operations, issued by the Gazette of Eritrean Laws, Vol. 5/1995, No. 2, Asmara, March 20, 1995.”

76- Eritrean National Mining Corporation (ENAMCO) Proclamation, issued by the Gazette of Eritrean Laws, Vol. 15/2006, No. 5, Asmara, December 18, 2006.

77- Article 6, Proclamation No. 157/2006 governs the overall operations of the Eritrean National Mining Corporation.

78- ‘The Petroleum Operations Proclamation, issued by Gazette of Eritrean Laws, Vol. 3/1993, No. 8, Asmara, July 1, 1993’.

79- ‘A Legal Notice to Regulate Petroleum Operations, issued by Gazette of Eritrean Laws, Vol. 5/1995, No. 8, Asmara, July 22, 1995’.

80- The Revised Regulations On Petroleum Operations, issued by the Gazette of Eritrean Laws, Vol. 9/2000, No. 3, Asmara, July 15, 2000.

81- The Revised Petroleum Operations Proclamation No. 108/2000, issued by the Gazette of Eritrean Laws, Vol. 9/2000, No. 3, Asmara, July 15, 2000.

ment”. Moreover, “The Ministry of Agriculture, in collaboration with the Ministry of Health and the Ministry of Land, Water and Environment and other concerned bodies shall revise and update the national pesticide list as and when required.”

As for the Ministry’s responsibility of conducting inspection and disposal, Article 10 of the Proclamation stipulates that: “Regular inspection activities [to] be carried out by the Ministry of Agriculture in pesticide stores and premises as well as during pesticide application to ensure that pesticides are properly stored and applied and [to] assess the condition of the pesticides in order to take the necessary measure”. Furthermore, “The Ministry may in collaboration with concerned institutions make every effort to ensure the safe disposal of obsolete pesticides”.

### G. Health Policy, Law and Regulation

The Ministry of Health (MoH) has, inter alia, the responsibility of providing health services to the public with special emphasis on provision of basic health care<sup>83</sup>; [...] taking the necessary measures to enforce health care related laws and regulations<sup>84</sup>, and conducting health care awareness raising campaigns<sup>85</sup>. The Ministry is responsible for the sound management of public health. It administers most of the hospitals in the country. Mercury is used in hospitals, health centres and medical laboratories, dental clinics, as well as medical equipment such as in thermometers. The hospitals emit mercury to the atmosphere from the medical wastes they incinerate which includes chemical wastes, pathological wastes, and highly infectious wastes.

Despite this fact, the Ministry doesn’t have any specific policy which it follows or a legal instrument that governs the importation, administration and proper use of mercury or mercury added products. Moreover, the National Health Policy of 2010 does not address this issue directly. The only legal instrument that could be indirectly applicable in this respect is the Proclamation No. 36/1993<sup>86</sup> which generally determines the responsible body<sup>87</sup> and its mandate over these products<sup>88</sup>.

The Ministry has, among others, the mandate of inspecting, monitoring, issuing permits and licenses pertinent to the control of medicines, medical equipment, cosmetics and sanitation products. Accomplishing this mandate is the responsibility of the Department of Public Health. Through the Department of Pharmaceuticals and Health Care Appliances, the MoH has the power to ban and restrict the use of mercury added cosmetics products.

The Ministry’s active engagement in addressing the health problems that were suspected to be caused as a result of the use of or exposure to mercury was limited to few communities within some regions of the country where ASGM activities were predominantly being conducted. With the prospect of the potential of the country

to conduct industrial mining operations and to some extent ASGM, the effects of mercury pollution across the country may be a challenge to the Ministry because such measures, especially awareness raising campaigns, are not being taken at every health care institution run by the MoH.

### H. Marine Resources Policy, Law and Regulation

The legislation governing this sector comprises of two proclamations and five legal notices (regulations) all promulgated in May 1998 and revised in 2014. These laws provide comprehensive coverage of the marine sector in Eritrea and contain a number of provisions relevant to environmental protection and sustainable use, including mercury. These legislations are meant to regulate the mercury content in the fishery products which are suitable for human consumption.

The Fisheries Proclamation No. 176/2014<sup>89</sup> delegates ‘the administration of the marine resources to the Ministry of Fisheries.’<sup>90</sup> The main objective of this Proclamation is ‘to ensure that exploitation of living marine aquatic resources is consistent with sustainable economic, environmental and social conditions.’<sup>91</sup> Regarding protected species and protected areas, it is stipulated that ‘no person shall discharge or deposit waste or any other polluting matter.’<sup>92</sup>

Proclamation No. 105/1998<sup>93</sup> states that, ‘fishery products containing other toxins, such as histamine, mercury in an amount higher than the levels established in chapter 5, part II of the Fishery Product Regulations<sup>94</sup> are prohibited from being placed on the market.’ Quality control is assured through the application of sample analysis in an approved laboratory by the competent authority for the purpose of checking, cleaning and disinfecting methods, and for the purpose of checking compliance with the standards established by the Fishery Product Regulations.<sup>95</sup>

#### i) Legal Notice No. 66/2003 -Heavy Metals Regulations

This Regulation lays down the measures for the monitoring of the heavy metals: Mercury, Lead and Cadmium in fishery and aquaculture products. The basic purpose for the establishment of sample preparation procedures and criteria of methods for analysis is to obtain a representative and homogenous laboratory sample without introducing secondary contamination so as to obtain representative results for the determination of the levels of the contaminants which may be heterogeneously distributed in a lot.

The provisions for the sampling and methods of analysis have been drawn up on the basis of present knowledge and they may be adapted to take into account the advances in scientific and technological knowledge. Thus,

82- “A Regulation for Importation, Handling, Use, Storage and Disposal of Pesticide, issued by the Gazette of Eritrean Laws, Vol. 15/2016, No. 5, Asmara, December 18, 2016”.

83- Article 2(14)(1) of Legal Notice No. 14/1993.

84- Article 2(14)(4) of Legal Notice No. 14/1993.

85- Article 2(14)(7) of Legal Notice No. 14/1993.

86- Proclamation No. 36/1993 - A Proclamation to Control Medicines, Medical Equipment, Cosmetics and Sanitation Products, issued by the Gazette of Eritrean Laws.

87- Articles 3 and 4 of Proclamation No. 36/1993.

88- Article 76 of Proclamation No. 36/1993

89- Fisheries Proclamation No. 176/2014, issued by the Gazette of Eritrean Laws, Vol. 24/2014, which revised Proclamation No. 104/1998, issued by the Gazette of Eritrean Laws, Vol. 8/1998, No. 4, Asmara, May 25, 1998.

90- Article 4 of Proclamation No. 176/2014.

91- Article 8 of Proclamation No. 176/2014.

92- Article 12 (6)(d) of Proclamation No. 176/2014.

93- Proclamation No. 105/1998 - The Fishery Product Proclamation, issued by the Gazette of Eritrean Laws, Vol. 8/1998, No. 4, Asmara, May 25, 1998.

94- Legal Notice No. 40/1998, issued by the Gazette of Eritrean Laws.

95- Article 10(2)(c) of Legal Notice No. 40/1998.



sampling is the responsibility of the Fish Inspection and Quality Control Division of the Ministry of Fisheries<sup>96</sup> and the mean total mercury content, as determined by the analysis of the edible parts of the fishery products shall not exceed 0.5ppm (0.5mg/kg of fresh weight).<sup>97</sup>

ii) **Legal Notice No. 68/2003 – Potable Water Regulation in Fishery Product Activities**

This regulation is concerned with the standards of potable water to be observed in fishery product activities and its objectives are: to protect human health from the adverse effects of any contamination of potable water intended for fishery product activities by ensuring that it is wholesome and clean.<sup>98</sup> Quality standards and control, monitoring and information and reporting of the potable water used in fishery products are to be carried by the Ministry of Fisheries. However, the question is whether the infrastructure in terms of the required laboratories are functional and well equipped.

**I. Trade and Industry Policy, Law and Regulation**

The MoTI is the responsible government institution for the issuance of permits and control of chemicals in general and mercury and mercury containing products in particular; controlling the standard of imported and exported goods and certify them. The Ministry has the obligation to formulate and development of policy and legislations pertinent to industry, including the management of industrial chemicals.

• **Eritrean Standards Institute (ESI)**

The institute is established pursuant to proclamation No. 75/1995 (issued by Gazette of Eritrean Laws, Vol. 5/1995) and Legal Notice No. 33/1997 (issued by Gazette of Eritrean Laws, Vol. 7/1997). The Regulations to Declare Eritrean Standards - Proclamation No. 75/1995 provides the list of Eritrean Standards of the items declared to be compulsory Eritrean standards and the standard determination of mercury in salt, for example as: ES-B.22:1997.

**Custom Tariff Regulations<sup>99</sup>**

Mercury was legally levied at 2% based on this customs tariff regulation which is substituted by Legal Notice No. 52/2001 (issued by Gazette of Eritrean Laws, Vol. 11/2001). This tariff is set internationally. However, it doesn't mean that it is allowed to import mercury into Eritrea. Currently, mercury is not included under the list of banned/prohibited chemicals to be imported into Eritrea. This list is issued by the DoE of the MoLWE, making the DoC as the executing organ in the controlling the chemicals that are imported into the country. Hence, any person who wants to import mercury needs to declare it before it is exported from the country of export.

**J. Labour and Social Welfare Policy, Law and Regulation**

The Ministry of Labour and Social Welfare (MoLSW) has the mandate to care for the issues of labour, especially child labour. The Labour Proclamation No.

118/2000<sup>100</sup> under Section 2 provides for the working condition of young employees. In particular, Article 68 prohibits the employment of a child under the age of fourteen years and Article 69 prohibits employment of young employees in activities connected with toxic chemicals, dangerous machines, electric power generation plants, transformers or transmission lines; underground work, such as mines, quarries similar works.

**K. Enforcement Agencies - National Police, Eritrean Navy, Security and Department of Customs (DoC) Policy, Law and Regulation**

The Department of Customs under the Ministry of Finance main regulatory power is to check upon illegal imports and confiscate them in accordance with the law in collaboration with the Eritrean Police the Eritrean Navy and other law enforcement agencies. In particular, the importation and use of illegal mercury is tightly controlled by the said institutions. Thus, these institutions play a crucial role in the enforcement of the national laws and regulations that are pertinent to mercury. The Department of Customs is especially responsible for controlling the import and export of regulated goods; to carry out preventive measures and confiscation of goods smuggled into the country. The Eritrean Police and the Department of Customs can also provide data and information on mercury and mercury added importation including trans-boundary movement thereof.

**L. Academic and Research Institutions Policy, Law and Regulation (The National Institute of Higher Education and Research)**

The Eritrean Science and Technology Development Agency's (ESTDA)<sup>101</sup> objectives are:

- Promote and coordinate the application of science and technology in the overall development of the country under the guidance of National Science and Technology Council (NSTC) established under Article 2; and
- Build up national capability for research and development of science and technology<sup>102</sup>
- Establish science and technology research and development institutions, science and technology service institutions, science and technology education institutions, science and technology research foundations<sup>103</sup>.

The issue of exerting and coordinating efforts in the fight against mercury pollution partially depends on using latest know-how and advanced laboratories which are oriented by the above-mentioned science and technology policy.

**M. Local Government Policy, Law and Regulation**

Proclamation No. 86/1996, a Proclamation for the Establishment of Local Governments, is an important part of the Government's policy of regional decentralization

96- Article 3 of Legal Notice No. 66/2003.

97- Article 4 of Legal Notice No. 66/2003.

98- Article 2 of Legal Notice No. 68/2003.

99- Legal Notice No. 18/1994 - Custom Tariff Regulations, issued by Gazette of Eritrean Laws, Vol. 4/1994.

100- The Labour Proclamation No. 118/2000, issued by the Gazette of Eritrean Laws, Vol. 10/2001, No. 5, Asmara, November 15/2001, The Labour Proclamation No. 118/2000, issued by the Gazette of Eritrean Laws, Vol. 10/2001, No. 5, Asmara, November 15/2001.

101- Proclamation No. 122/2002 – The Eritrean Science and Technology Development Agency (ESTDA) Establishment, issued by Gazette of Eritrean Laws, Vol. 11/2002, No. 3, July 1, 2002.

102- Article 6 of Proclamation No. 122/2002.



of administration and, more importantly, control and implementation of development policy. This legislation has major implications for environmental protection and sustainable utilization thereof.

## **N. Maritime Transport and Communication Policy, Law and Regulation**

The governing legal instrument for maritime transport is Legal Notice No. 46/2000, also known as the Eritrean Port Regulations. This Legal Notice defines “pollution” under Article 3 as “any alteration of the environment caused by discharging waste, chemicals, hazardous substance or other pollutants in a manner which creates a hazard or potential hazard to human beings, biodiversity, or the socio-economic conditions”.

One of the main functions of the Port Management is the preparation and implementation of pollution prevention plans and emergency response plans in cooperation with other concerned agencies<sup>104</sup>. In particular, this legislation adopts the definition of “dangerous goods in the International Maritime Dangerous Goods Code (IMDG) Article 66 (b) poisonous goods such as potassium-cyanide, acids and chlorine; (g) miscellaneous dangerous substances which experience has shown or may show to be of a dangerous character. It is the prime responsibility of the port management to protect the marine environment against pollution of the said dangerous goods”.<sup>105</sup>

## **O. Information and Educational Policy, Law and Regulation**

The Press Proclamation No. 90/1996 (issued by Gazette of Eritrean Laws, Vol. 6/1996) provides a legal framework for freedom of press and information within Eritrea. The Ministry of Information has the potential to be a major facilitator of the dissemination of mercury related health issues and information and those sectors concerned with the management of mercury should work closely with this Ministry.

Similarly, the Ministry of Education is the Government organ which uses the curriculum to advance the overall development issues, and in particular, the dissemination of health issues such as the adverse effects of illegal mercury use through formal and informal educational facilities. Thus, the MoE becomes a very important player in the fight against the critical health hazards of illegal use of mercury.

### **4.3 Specific Recommendations Resulting from the Policy, Legal and Regulatory Capacity Assessment**

- In order to meet the requirements of sound management of Mercury and hence to comply with the provisions of the Minamata Convention, the needs are the following:
- Adopting environmental regulations, rules, procedures, manuals and directives related to the enforcement of environmental policies, laws and regulations especially related to the management and use of mercury;

- Elaborating specific standards related to emissions to air, land or water from mercury or mercury compounds in the upcoming chemicals/hazardous waste management legislation;
- Adopting a legal framework for governing ASGM and mercury use and management needs, including the formalization of the ASGM sector;
- Put in place a system for continuous synchronization and review of the existing policies, laws, regulations, principles, rules, procedures and working manuals dealing with mercury use and management; Domestic international environmental treaties, conventions and laws into the national legal framework for enhancing and supporting national laws; Based on the Initial Assessment to consider the ratification and domestication of the Minamata Convention
- Prepare and adopt special provisions relating to the different aspects of mercury use and management in the upcoming legislation on chemicals/hazardous waste following the provisions of the Minamata Convention, including the following elements related to relevant articles of the Convention for Eritrea:
  - \* Article 3: the recommended upcoming legislation should address the issue of primary mercury mining;
  - \* Article 4: the recommended upcoming legislation should prohibit the manufacture, import, and export of products listed in Part I of Annex A; take measures to prevent the incorporation of products listed in Part I of Annex A (i.e., switches and relays, batteries) into larger, assembled products; and Discourage the manufacture and distribution of new mercury product types;
  - \* Article 5: the recommended upcoming legislation should address the issue of the use of mercury in manufacturing or in industrial processes;
  - » Article 7: the recommended upcoming legislation should reduce/control mercury use in ASGM and emissions/releases from ASGM;
  - » Article 8: the recommended upcoming legislation should provide for BAT/BEP and ELVs for new sources of mercury, control/reduce emissions of existing sources and require reporting/monitoring/inventory;
  - » Article 9: the recommended upcoming legislation should provide for access to information of significant sources of mercury release, maintain inventory of such releases and control/reduce mercury and mercury compound releases to land and water;
  - » Article 10: the recommended upcoming legislation should provide for environmentally sound interim storage of mercury;
  - » Article 11: the recommended upcoming legislation should clearly provide for regulations regarding mercury waste disposal management. Also, maritime transport legislation has to develop rules for trans-boundary transport of mercury;
  - » Article 12: the recommended upcoming legisla-

<sup>103</sup>- Article 7 of Proclamation No. 122/2002.

<sup>104</sup>- Article 6(g) of Legal Notice No. 46/2000.

<sup>105</sup>- Article 95 of Legal Notice No. 46/2000.

tion should provide for the assessment of mercury/mercury compound contaminated sites;

» Article 16: the recommended upcoming legislation should include and address mercury or mercury compound use related health problems;

» Article 19: Make the Science and technology legislation functional and necessary regulations for its effective implementation should be developed to promote research, development and monitoring.

- The Courts, prosecution, and the national police and security agencies should be given legal powers within the context of the Civil Code, Civil Procedure Code, Criminal Code, Criminal Procedure Code or the recommended upcoming legislation on mercury use to prevent mercury related crimes and extra-contractual liability;
- Individuals whether Eritreans or foreign nationals engaged in the illegal production, sale, use, import, export, trans-boundary transport and stockpiling of mercury and mercury containing compounds or any other items that are enumerated under the Convention should be criminally and civilly held liable.

#### **4.4 Institutional Infrastructure for the Management of Mercury**

##### **A. Ministry of Land Water and Environment (Department of Water)**

###### **1. Capacity of Chemistry Laboratory**

The laboratory of this Department conducts analyses of the water samples that come from ground, surface water as well as wastewater that is released from different industries. The analyses conducted by the laboratory are:

- a. Biological quality of the water samples
- b. Physio-chemistry of the water samples

The physio-chemistry laboratory analysis is conducted to analyze the physical parameters of the water sample such as: colour, turbidity, odour, temperature, oxygen and the chemical parameters of the water sample such as: 12 kinds of heavy metals including mercury, salinity, pH, hardness, nitrogen groups, sulphate, fluoride, alkalinity, and chloride.

###### **2. Gaps and Barriers of the Physio-chemistry Laboratory**

The scientific Atomic Absorption Spectrometer machine that detects the heavy metal content of water samples is currently not functional due to the lack of some re-agents. The laboratory is also faced with shortage of qualified personnel to operate some of the instruments found in its possession.

##### **B. Ministry of Energy and Mines (Department of Mines)**

The laboratory of this Department analyzes the mineralogical composition of the rock, soil and water samples that are collected from the mining sites and other explo-

ration areas. The laboratory has two components;

- a. Geological laboratory
- b. Chemistry laboratory (analyses the chemistry of soil/ ore samples)
  1. Capacity of Chemistry Laboratory

The chemistry laboratory is the laboratory that analyzes the heavy metal concentration in the ore samples (soil samples) and water samples mainly from the mining sites and other exploration areas.

###### **2. Gaps and Barriers**

Because of the absence of standard requirements, the chemistry laboratory fails to analyze other heavy metals other than copper, iron and zinc. Nonetheless, the laboratory analyzes the concentration of heavy metals of the samples taken from ore and water only.

##### **C. Ministry of Trade and Industry (Eritrean Standard Institution)**

The ESI laboratory conducts laboratory tests to ensure the quality of various products such as building materials, food stuffs and beverages that are either imported or exported and produced in the country for domestic usage. This laboratory has three components. These are: The Chemical lab, the Microbiology Lab and the Engineering Lab.

###### **1. Capacity of the Chemical Laboratory**

The chemical laboratory conducts chemical analysis of foods and beverages for alkalinity, acidic value, insoluble impurities, pH, moisture, volatility etc.

###### **2. Gaps and Barriers of the Chemical Laboratory**

The instrument that is used to analyses the metallic content/ level of the heavy metals is not functional at this time because of lacks of some standards and reagents.

##### **D. The Ministry of Agriculture**

The MoA has two laboratories, namely the National Animal and Plant Health Laboratory (NAPHL) which conducts pathological diagnostic tests on animals and plants, quality control and vaccination. The second one is the National Agricultural Research Institute (NARI) that comprises three components under it, namely: The Tissue Culture Laboratory, the Diagnostic Laboratory and the Seed Quality Laboratory.

###### **1. Capacity of the NAPHL Laboratory**

The NAPHL has the capacity to diagnose plant and animal diseases and to conduct quality control on vaccines, food and animal feed.

###### **2. Gaps and Barriers of the NAPHL Laboratory**

The NAPHL laboratory does not analyze the mercury content in pesticides, fertilizers and other agrochemicals. There is also shortage of qualified staff to operate the lab instruments and some of the laboratories of the Ministry do not follow the Standard Operating Procedure (SOP).

##### **E. Bisha Mining Share Company**

BMSC has a highly developed infrastructure that plays a significant role on the management of mercury such as laboratories and waste disposal sites (sites where solid waste and wastewater are disposed).

#### 1. Capacity of the Laboratories at the BMSC Mine Site

The BMSC has two laboratories which have the mandate to collect and analyse samples with heavy metal contents. One is the SGS laboratory that analyzes the heavy metal content of the ore samples including mercury content and the second one is the laboratory of the DoE located at the BMSC mine site. This laboratory collects different samples such as: dust, water, soil and vegetation samples found within the mining area and sends them to be analysed (the metallic concentration including mercury content) to an international laboratory called ALS Laboratory.

With regard to waste management of the mining project, the BMSC uses different technologies to control mercury release to the environment, such as:

1. BMSC uses a well-designed Tailing Management Facility (TMF) that collects the processed slurry (with high concentration of heavy metals and other chemicals used for concentrating or extracting minerals) that comes from the processing plant.

2. At BMSC, wastes are segregated and disposed according to their nature. The hazardous liquid mine waste, the slurry is discharged on to the TMF basin, which is closely monitored and has a highly compacted area covered by 1.5 mm thick special High-Density Polyethylene (HDPE) liner that is one face textured to prevent any leakage to the ground. The used oils are collected properly and sent to TOTAL Eritrea's motor oil recycling plant in Massawa. The hazardous wastes are segregated from the non-hazardous ones. Some reusable materials are used again by the company or given to the MLSW for the use to the local communities. The non-reusable materials are disposed in the burn pits. Defective fluorescents are handled and disposed cautiously, as they contain mercury. A special instrument is used to crash the fluorescents that do not allow the mercury to escape to air.

#### F. Zara Mining Share Company

The laboratory located within the ZMSC processing plant is the only laboratory that analyzes heavy metal content at ZMSC and the heavy metals analyzed within this laboratory are gold and silver only.

#### 1. Waste Management and Disposal

The project disposes its wastewater from the processing plant with different contents of heavy metals and other chemicals using the Dry Stacking Technology. In general, here and there, one can observe a small room for improvement of waste disposal system at ZMSC, but the Dry Stacking Technology is one of the advanced systems to treat the slurry. The water that comes from the processing plant is recycled at the processing plant and then the waste is disposed at the Tailing Management Facility

(TMF), which is closely monitored and has a highly compacted area covered by 1.5 mm thick special High-Density Polyethylene (HDPE) liner that is one face textured HDPE liner to prevent any leakage to the ground.

## 4.5 Institutional Assessment

The current Assessment on the National Institutional Infrastructure and Capacity for the Management of Mercury Including National Legislation is believed to give a clear picture of the current situation of the anthropogenic, releases and the management of mercury in Eritrea. The assessment presented below has served as a wakeup call to many of the institutions that are covered under this assessment and will enable the country to make an informed decision whether or not to become a Party to the Convention.

### 4.5.1 Ministries

#### A. Ministry of Land, Water and Environment (MoLWE)

The Department of Environment under the Ministry of Land, Water and Environment is the department that is vested with the power to issue Environmental Proclamations and legal notices as well as conducting Environmental Impact Assessment, including monitoring of their implementation. This Ministry serves as the focal point for the implementation of various international environmental agreements, including various chemical conventions. It cooperates with government institutions and private sector and is responsible for ensuring environmentally sound management of resources and for controlling environmental pollutants release.

The Department of Environment (DoE), under this ministry, is the responsible department for the implementation of the Minamata Initial Assessment (MIA) on mercury and National Action Plan (NAP). It is in charge of the development of environmental, policies, laws, regulations, guidelines and also responsible for undertaking monitoring and evaluation of environmental status. In addition, in line with National Environmental Assessment Procedures and Guidelines, the Department evaluates and grants environmental clearance to any developmental project and undertakes regular inspection activities to ensure compliance.

#### B. Ministry of Energy and Mines (MoEM)

The Ministry of Energy and Mines has the mandate to formulate policies, legislations and regulations governing mines and mining operations and to oversee their implementation (Article 7 annex C). The Ministry also undertakes geological research in relation to the mining sites and operations.

The Department of Energy controls the release of pollutants including mercury from the combustion of coal and other fuels for energy consumption (Article 9 paragraph 5) and use/import of the alternative of mercury free products instead of mercury added products (Article 4 annex A paragraph 1). Compliance with mining regulations and directives is ensured through the Regional Department of



Mines Offices of the Ministry found in the six Administrative Regions which are coordinated by the Regional Administration of the Ministry of Local Government in collaboration with the Police and other law enforcement agencies.

### C. Ministry of Health (MoH)

The MoH is responsible for developing the overall health related policy, legislations and regulations based on the Eritrean National Policy goals to improve and safeguard the health of citizens. Hence, the Ministry is vested with mandate to establish various health care providing facilities of different levels across the country;<sup>106</sup> to issue health related laws and take the necessary measures for their implementation;<sup>107</sup> conduct health related awareness raising activities.<sup>108</sup> It can also oversee the implementation of such policy and legislations in relation to ASGM. The Ministry controls any public health concerns which cause pollution. With respect to public awareness activities, strong efforts are being made to convince the public about the negative effects of mercury on human health and the environment. The regulation of mercury in the health sector is governed by the National Health Policy and Environmental Policy.<sup>109</sup> The MoH could provide information on mercury related public health issues that arise as a result of exposure to mercury and involvement in ASGM and should work in reduction of environmental impacts of ASGM and the risk of exposure to the public.

### D. Ministry of Agriculture (MoA)

The MoA is responsible for the overall management of soil/land conservation and contamination by heavy metals such as mercury and, in particular by agrochemicals. It controls the import and use of Persistent Organic Pollutants (POPs) pesticides and mercury added pesticides, biocides and topical antiseptics (Article 4 part 1 of annex A). it also provides the Pest Control Unit (PCU) with the relevant information on research findings, applications, and environmental impacts and conducts research on alternative options like Integrated Pest Management (IPM). The Ministry of Agriculture (MoA) currently has mercury added agro-chemicals in its stock.

### E. Ministry of Justice (MoJ)

The MoJ is vested with the mandate to assist institutions in the development of regulatory mechanisms such as, legislations, regulations and directives. It is responsible only for the issuance, amendment, repeal and replacement of the basic laws (Codes) of the land. Specific, laws are issued by way of delegated legislation through the concerned ministry or government institution. The mandate of the Ministry is limited to providing legal advises to government institutions and approving the national regulation and oversee the coherence of sector regulatory instruments before approval. There is neither a policy nor a proclamation related with the proper administration and regulation of mercury that is issued by the Ministry.

The MoJ has legal experts with the capacity to assist oth-

er ministries, authorities and other government agencies in formulating the legal instruments issued by them. It is limited with the role and responsibilities of adjudicating disputes, enforcing court decisions through the various levels of Courts. The MoJ is important to the Convention and the specific situation of Eritrea in formulating a legal instrument that reflects the realities of the country and compatible, as much as possible, with the Convention. Furthermore, its institutions, namely the courts and prosecution offices, are the organs that will enforce the national legislation on mercury.

### F. Ministry of Education (MoE)

The Ministry of Education, pursuant to Legal Notice No. 14/1993, *inter alia*, has the mandate to provide education to all citizens across the nation, ensure the implementation of the education policy of the country as well as prepare and disseminate educational programs. The MoE is the relevant government institution for the implementation of strategies that would contribute for community outreach activities and stakeholders' involvement in the awareness raising programs to reduce the number of students who drop out of school and involve themselves in the ASGM sector thereby exposing their health to the detrimental effects of mercury and provide valuable information and conduct research on mercury related issues and the curriculum and involvement of students.

The Ministry of Education (MoE), Department of curriculum expects the establishment of laboratories in schools and from the safety manual, some mentioning of mercury as an element is made, but no mention or awareness on mercury adverse neurological effects. Based on the deliberation of the chemistry panel efforts should be made to discover these adverse effects in order to set up campaigns to prevent the society from being victims. Data regarding mercury used in nationwide laboratories is also available with the department.

### G. Ministry of Transport and Communication (MoTC)

This Ministry overlooks, in addition to national communication system, the national transport system on land, air and maritime traffic. Owners of current vehicles are legally obliged to register their vehicles and undergo technical inspection every year and to get the permission for traffic participation. This ministerial responsibility is legally guided by the Eritrean Port and Maritime Regulation (2005), the Land Transport Proclamation (2000) and the Transportation of Goods Regulation (2002).

### H. Ministry of Marine Resources (MoMR)

The MoMR has the mandate to regulate, conserve and develop marine resources<sup>110</sup> and to protect the marine environment from pollution, under the theme of sustainable exploitation<sup>111</sup>. To achieve this objective, it has issued several legislations. The Ministry owns Quality Control Laboratory for fish, fishery products, Water and ice in both microbiological and chemical analytical procedures

106- Article 14(2) of Legal Notice No. 14/1993

107- Article 14(4) of Legal Notice No. 14/1993

108- Article 14(7) of Legal Notice No. 14/1993

109- ASSESSMENT OF HEALTHCARE WASTE MANAGEMENT AND ACTION PLAN FOR POLICY IMPLEMENTATION IN ERITREA, 2009, Environmental Health Unit, Ministry of Health, Eritrea.

110- Article 10(1) of Proclamation No. 14/1993.

111- Article 10(5) of Proclamation No. 14/1993.



including heavy metal analysing equipment AAS.

#### **I. Ministry of Labor and Social Welfare (MoLSW)**

The MoLSW is mandated to regulate the interests, well-being and safety of citizens in labor relations. To accomplish its mandate the Ministry, inter alia, obliges by way of legislation employers to take all the necessary occupational safety and health measures and to comply with the standards and directives or by the appropriate authorities in respect of these measures to take appropriate measures<sup>112</sup> early on to ensure that all work place premises and the processes of work do not become a source or cause of hazards to the health and safety of the employees<sup>113</sup>.

Furthermore, the Minister of MoLSW is empowered to issue regulations or directives necessary for the implementation of the Labor Proclamation, in particular with respect to occupational safety, health and the protection of the working environment; standards of working conditions; classification of hazardous occupations; types of occupations which are particularly arduous and dangerous to the health and to the reproductive system of female employees<sup>114</sup>.

#### **J. Ministry of Information (MoI)**

The mandate of the Ministry of Information is to “serve [the] society by disseminating credible and reliable information on political, social, economic and environmental issues and influence the attitude of the public to contribute in the nation’s building.” In this regard, the Ministry could contribute by disseminating valuable information to the public about the health and environmental effects and sound management of mercury. This ministry is the most crucial institution in the dissemination of the awareness programs.

#### **K. Ministry of Local Government (MoLG)**

The Ministry of Local Government is the government ministry that is vested with the power to administer the various administrative divisions of the country. Within the legal powers of this Ministry, it may implement any laws and regulations that are delegated to it for execution up to the lowest administrative division level. The municipality and sanitary unit under the Ministry of Local Government are responsible to control the overall sound management of waste including hazardous and medical waste.

#### **L. Ministry of Foreign Affairs (MoFA)**

The Ministry of Foreign Affairs (MoFA) is the political focal point for the ratification and accession of all treaties, including, environment-related Conventions; offers legal and political support; communicates information to and from the international partners. It has the mandate to accede, ratify and sign Conventions that Eritrea intends to be bound by<sup>115</sup>.

#### **M. Ministry of Trade and Industry (MoTI)**

The MoTI is the ministry with the mandate to formulate and develop policy and legislations pertinent to trade and industry, including the management of industrial chemicals in general as well as mercury and mercury containing products in particular. It also has the power to regulate the production, use, and unintended emission of chemicals. Along with other activities, the MoTI is responsible for the issuance of permit and control of Industrial chemicals. To this end it has developed a licensing system for importers of all chemicals. The ministry also regulates the production, use, and the unintended emission of chemicals and encourages the application of clean technology (BATs/BEPs). The Ministry uses all regulations and ratified conventions in issuing import and export permits.

#### **N. Eritrean Standards Institute (ESI)**

The Eritrean Standards Institute (ESI), an autonomous institution which functions under the MoTI, sets the standards for different products and services; ensures whether national standards are met in the economic sector and accordingly issues certificates. The institution, inter alia, has the mandate to prepare and revise compulsory Eritrean standards relating to products, practices and processes<sup>116</sup>; examine or test products to ensure conformity to Eritrean standards<sup>117</sup>; certify import and export products which conform to Eritrean standards<sup>118</sup>.

The Eritrean Standards Institution does not have a clear mandate in relation to the control and regulation of mercury and mercury added products. This is due to the fact that this institution has not, so far, set any standards for mercury which is defined by law whether it is in its elemental form, or as mercury compound, or in mercury added products.

#### **O. Ministry of Finance (MoF)**

The Ministry of Finance has the mandate to ensure the determination, collection and deposit of taxes, duties and any government revenues<sup>119</sup>. The Department of Customs under this Ministry is to control the illegal import, export, if any, and use of mercury in Eritrea. The Department is especially responsible for controlling the import and export of regulated goods; to carry out preventive measures and confiscation of goods smuggled into the country. These institutions may play a crucial role in the enforcement of the national laws and regulations that are pertinent to mercury.

As part of the desktop study, the mandates, capacity, gaps and barriers of the following institutions have been identified as relevant for the implementation of sound management of mercury. Generally, the governing mandates of the various national institutions<sup>120</sup> are posited under the Eritrean National Policy and the Proclamations that constituted them. As far as the institutions that were the subject of the assessment is concerned, many of them do not have specific mandate for the proper management of mercury. Table 4.1 presents the findings of the assessment for each relevant ministry.

112- Article 20(4) of Proclamation No. 118/2001.

113- Article 20(9) of Proclamation No. 118/2001.

114- Article 140(a-d) of Proclamation No. 118/2001.

115- Article 2(5)(2) of Legal Notice No. 14/1993.

116- Article 7(1) of Proclamation No. 75/1995.

117- Article 7(5) of Proclamation No. 75/1995.

118- Article 7(6) of Proclamation No. 75/1995.

119- Article 2(7)(3) of Legal Notice No. 14/1993

120- The Institutions that were the subject of the survey were: the Ministry of Land, Water and Environment, the Ministry of Energy and Mines, the Ministry of Agriculture, the Ministry of Trade and Industry, Ministry of Justice, the Maelkel Region Environment Division (MRED), the National Union of Eritrean Women, Ministry of Labor and Social Welfare, the National Police and Security Forces, the ESI, Zara Mining Share Company, Bisha Mining Share Company, Hirigwo Power Plant.

Table 4.1. Assessment for Each Relevant Ministry

Institution	Mandate	Existing Capacity	Gaps and Barriers
MoLWE (DoE)	<ul style="list-style-type: none"> <li>Vested with the power to issue Environmental legislations and overseeing and monitoring</li> <li>Conducting EIA</li> <li>Focal point for the implementation environmental conventions</li> <li>Ensuring environmentally sound management of resources</li> <li>Control pollutants release</li> </ul>	<ul style="list-style-type: none"> <li>Conducts assessment of mercury and mercury containing compounds to identify the pollution level and report to the responsible body.</li> <li>Conducts mercury emission inventory</li> <li>Manages mercury waste by identifying mercury containing wastes and provides guidance to the pertinent body as to how to handle and dispose hazardous wastes.</li> <li>Provides guidance on how to identify, assess and minimize risks arising from mercury handling and disposal.</li> </ul>	<ul style="list-style-type: none"> <li>Inadequate tools. Absence of a legislation governing the proper management of mercury containing wastes.</li> <li>Absence of national standard,</li> </ul>
MoEM	<ul style="list-style-type: none"> <li>Formulate policy, legislation and regulations governing mines and mining operations</li> <li>Issues import permits for materials necessary in mining operations</li> <li>Undertakes geological researches</li> <li>Makes sure that large scale mining operations follow waste management plan and procedures</li> <li>Promotes occupational exposure, educational and prevention programs</li> </ul>	<ul style="list-style-type: none"> <li>Conducts inspections on mining companies to ensure appropriate environmental waste management plan is prepared and that they provide a list of all harmful substances available.</li> <li>The DoM has adequate staff and mechanism to conduct such inspections.</li> <li>Has once conducted mercury contamination assessment on mines from the Italian colonial era as well as from ASGM activities.</li> <li>Calls for the observance of appropriate safety practices in mining operations, by conducting safety induction and sensitization programs, the provision of Personal Protective Equipment (PPE).</li> <li>Does a commendable work in regulating large scale mining operations for the effective manage of the environment in relation to mercury.</li> </ul>	<ul style="list-style-type: none"> <li>Financial constraints to assess mineral potential sites.</li> </ul>
MoA (NAPHL and NARI)	<ul style="list-style-type: none"> <li>Responsible for the management of soil conservation and contamination from agrochemicals</li> <li>Controls the import and use of POPs pesticides and mercury added pesticides, biocides and topical antiseptics</li> </ul>	<ul style="list-style-type: none"> <li>Conduct toxicology analysis on poisonous substances including mercury, also the proper handling of and disposal of mercury containing compounds to protect the environment from mercury release.</li> <li>Prevents or limits mercury use in the process of wastewater treatment system and release therefrom.</li> <li>Manages, as much as possible, mercury waste by controlling releases, limiting uses and exposures from instruments and compounds during laboratory analysis; properly disposes mercury containing compounds or wastes; observes proper storage and laboratory practices.</li> <li>Fill the chemical data sheet and apply good storage practices according to the directions provided by the manufacturer/ supplier of the chemical.</li> <li>The NAPHL observes scientific way of management and disposal of wastes.</li> </ul>	<ul style="list-style-type: none"> <li>The NAPHL lacks equipment such as High-Performance Liquid Chromatography and Gas Chromatography-Mass Spectrometry to identify the residue level of the wastewater</li> <li>Inadequate qualified staff to identify and manage mercury waste in the laboratory Financial constraints</li> </ul>
MoTI (DoI)	<ul style="list-style-type: none"> <li>Formulates and develop policy and legislations pertinent to trade</li> <li>Is responsible for the issuance of permits and control of industrial chemicals</li> <li>Regulates the production, use, and emission of chemicals</li> </ul>	<ul style="list-style-type: none"> <li>Obliges investors to incorporate the Best Available Techniques (BAT)/ Best Available Practices (BAP)/ Emission Value Limits (ELVs) for cement production</li> <li>The Ministry prohibits the importation of chemicals, hazardous to human health and the environment.</li> <li>The Ministry strictly follows regulations and conventions when issuing import or export permits of hazardous chemicals, including in issuing permits of heavy metals.</li> </ul>	<ul style="list-style-type: none"> <li>The Ministry lacks qualitative and quantitative determination on mercury content.</li> </ul>

ESI (MoTI)	<ul style="list-style-type: none"> <li>Sets and revises compulsory standards relating to products, practices and processes</li> <li>Ensures whether national standards are met</li> <li>Issues certificates of conformity to import and export products</li> </ul>	<ul style="list-style-type: none"> <li>Owns various analytical tools for the assessment of different products.</li> <li>Conducts laboratory tests for presence of mercury on foodstuffs esp. salt.</li> <li>Has the mandate to deal with various chemicals, including mercury.</li> </ul>	<ul style="list-style-type: none"> <li>Constraints of the necessary laboratory equipment to identify mercury content in products</li> <li>Inadequate manpower and expertise.</li> </ul>
MoLG	<ul style="list-style-type: none"> <li>Administers the various administrative divisions of the country</li> <li>Control of the disposal of general wastes including hazardous and medical waste.</li> </ul>	<ul style="list-style-type: none"> <li>Provide important information concerning the mercury used in a given community and relevant information in relation to the ASGM sector</li> <li>Contribute in the development of an action plan for the proper management of mercury. They can also play a crucial role during the implementation of the action plan.</li> </ul>	N/A
MoJ	<ul style="list-style-type: none"> <li>Assist institutions in the development of various legislations.</li> <li>Responsible only for the issuance, amendment, repeal and replacement of the basic laws of the land.</li> </ul>	<ul style="list-style-type: none"> <li>Has legal experts with the capacity to assist other ministries, authorities and other government agencies in formulating the legal instruments issued by them.</li> <li>Adjudicate disputes, enforce court decisions through the various levels of Courts and Execution Offices.</li> </ul>	N/A
MoH	<ul style="list-style-type: none"> <li>Developing health related policy and legislations based on the Eritrean National Policy.</li> </ul>	<ul style="list-style-type: none"> <li>Conducts inspections on premises of businesses and the processes followed in a workplace to avoid any source of hazard to the health and safety of the employees.</li> </ul>	<ul style="list-style-type: none"> <li>Absence of proclaimed standard for occupational safety and health</li> </ul>
MoLSW	<ul style="list-style-type: none"> <li>Ensures the wellbeing of children, the youth and fostering the family.</li> <li>Obliges businesses to safeguard and maintain the safety and health of their employees and the workplaces</li> </ul>	<ul style="list-style-type: none"> <li>Conducts risk assessment on the health of the workers and obliges the pertinent body to mitigate the effect to the desired level Permissible Exposure Limit (PEL) at Time Weighted Average.</li> <li>The MoLSW endeavours to ensure environmentally friendly handling, transportation and disposal of chemicals and measures to insure interim mercury storage in accordance with the Eritrean Labour Proclamation.</li> <li>Necessary management plan and care services are provided in line with the draft National Occupational Safety and Health Standards if the affected individuals are workers.</li> <li>Gathers information on the Health and Safety of Humans and the Environment from various institutions.</li> <li>Develops and implements strategies that enable it to promote alternatives and reduce and, if possible, eliminate the exposure as well as to mercury use.</li> </ul>	<ul style="list-style-type: none"> <li>Absence of proclaimed standards on the overall occupational safety and health.</li> <li>No strategies that are aligned to address occupation health and safety.</li> </ul>
DoC	<ul style="list-style-type: none"> <li>Controls the illegal import and export of regulated goods.</li> <li>Take preventive measures on, cease and confiscate goods smuggled into the country.</li> <li>Ceases and confiscates prohibited (regulated) goods at designated points of entry and exit.</li> </ul>	<ul style="list-style-type: none"> <li>Provide an estimate of the amount of mercury imported into the country.</li> <li>Controls the import and export of regulated goods;</li> <li>Carries out preventive measures and confiscation of goods smuggled into the country.</li> </ul>	<ul style="list-style-type: none"> <li>The mandate to restrict the importation of mercury or any products determined by other institutions.</li> </ul>
The National Police, Eritrean Navy and Security Forces	<ul style="list-style-type: none"> <li>Enforcement of the national laws and regulations.</li> </ul>	<ul style="list-style-type: none"> <li>Provide data and information on illegal importation and dumping of toxic wastes on the sea trans-boundary movement of mercury.</li> </ul>	
NUEW	<ul style="list-style-type: none"> <li>Protecting and ensuring the rights and equality of women in social, economic and political spheres of the country.</li> </ul>	<ul style="list-style-type: none"> <li>Provides training to women to engage in various economic activities</li> <li>Mobilizes women activists to sensitize vulnerable women</li> </ul>	<ul style="list-style-type: none"> <li>Limited awareness about the about mercury and its effects</li> <li>Limited human and financial resources to conduct training and awareness activities on the sound management of mercury</li> </ul>
NUEYS	N/A	<ul style="list-style-type: none"> <li>Has considerable number of members and wide coverage across the country in the educational institutions of various levels and in the army.</li> <li>Raise the awareness effectively especially among the youth and students about the effects of mercury on human health.</li> </ul>	<ul style="list-style-type: none"> <li>Union's activities are limited to sensitizing the youth on political issues, STDs and conducting vocational trainings only.</li> </ul>

## 4.5.2 Other Institutions

### A. The Department of Customs

The Ministry of Finance (MoF) has the mandate to ensure the determination, collection and deposit of taxes, duties and any government revenues<sup>122</sup>. The Department of Customs under the MoF controls the illegal import, export, if any, and use of mercury in Eritrea. The Department is especially responsible for controlling the import and export of regulated goods; to carry out preventive measures and confiscation of goods smuggled into the country.

The Department of Customs is the duly authorized state department which deals with the handling of import and export of products in the country and monitors and regulates according to all pertinent legal framework. The Department of Customs has been found to be a good data resource, particularly for the importation of mercury added products like thermometer, light source, batteries, paints, cosmetics, etc. However, it should be borne in mind that the data provided by the DOC does not show the proportion of how much mercury is found in all the mercury added products but rather the total volume of mercury added products imported into the country.

### B. Eritrean Navy and police

This executive branch has been dealing with mercury related issues, its legality, and apprehending those with ties to the illegal trade of mercury and other mercuric compounds. The authority has been aware of the adverse effects of this harmful element and has in its evidence log a considerable amount contraband mercury and mercuric compounds. The Eritrean Navy plays a double role as army and as coast guard protecting our sea from illegal dumping of toxic wastes.

### C. The National Union of Eritrean Youth and Students (NUEYS)

The NUEYS has no relevant data on developing the mercury inventory or the initial assessment but could play a vital role later on in raising awareness of the societal groups they represent.

### D. The National Union of Eritrean Women (NUEW)

Similarly, the NUEW has no relevant data helpful in our cause but it is clear that it could play a key role in raising awareness and towards sensitization of Eritrean women and the society as a whole.

### E. International Organizations

The United Nations agencies and organizations involved in the MIA project and relevant to the implementation of the Minamata Convention at the national level are listed below in alphabetical order:

i) The United Nations Institute for Training and Research (UNITAR):

UNITAR's Chemicals and Waste Management Program has provided technical assistance in various areas such as: (i) training on the Toolkit for the national mercury in-

ventories, (ii) revision of the various individual reports, in particular the evaluation of the policy, legal and institutional frameworks, the environmental impact study and the inventory report. Furthermore, UNITAR supports the writing and revision of the final MIA report. UNITAR can also play a key role in the further implementation of the Minamata Convention.

ii) The United Nations Environment Program (UN Environment):

UN Environment is the United Nations agency specializing in the field of the environment and aims to: (i) Coordinate United Nations activities in the field of the environment; (ii) Assist countries in the implementation of environmental policies and (iii) Encourage sustainable development. Through its mercury Program, UN Environment plays a significant role in the management of mercury. Eritrea used inventory Toolkit to carry out the national mercury inventory. For the continuation of activities under the Minamata Convention, it will be necessary to involve UN Environment in all aspects related to environmental protection and the management of chemicals, including mercury, and waste.

## 4.6. Specific Recommendations Following the Institutional Capacity Assessment

Having seen the roles and responsibilities of the various institutions, the following measures are the steps that need to be taken to ensure that the institutional capacity is in place to implement the ensure the sound management of mercury in particular and the Minamata Convention in general including concrete recommendations such as the responsible actors, timeframe or budget. In order to comply with the provisions of relevant Articles for Eritrea, the institutions should:

- Prohibit the manufacture, exportation and importation of any mercury, phase-out mercury added and Mercury containing products;
- Adopt efficient and effective pollution prevention measures;
- Provide capacity building programs to the pertinent institutions involved in the management of mercury in any way
- Invest in programs in order to control releases and emissions of mercury to the environment;
- Reduce the use of raw materials with mercury and products that generate mercury;
- Members of the law enforcement agencies should be given the opportunity to enhance their capacity through the participation in awareness raising trainings workshops etc. should have access to resource material on mercury
- Adequate budget should be allocated to equip the law enforcement agencies with adequate tools, equipment and facilities in order to execute their obligation for the proper management of mercury.
- Take appropriate measures for the proper handling,



management mercury waste and other wastes;

- Government institutions that deal with the issue of environmental protection and management and use of mercury need to be strengthened because they are either in their inchoate stage or else still dysfunctional, example, the NEC. the
- Monitoring and evaluation systems and mechanisms should be enhanced;
- Safety standards should be developed;
- Train and develop qualified professional and technical expertise in environmental protection and management, in particular mercury management and use. For example, lab technicians;
- Develop and implement adequate and qualified training programs;
- Establish good laboratory and laboratory practice to undertake effective analysis of mercury content in products as well as in waste.

- Enhance the coordination and collaboration between all stakeholders involved in environmental protection for example, through the, National Environmental Council (NEC) and the environment unit to be established in all concerned line ministries and other government institutions pertinent to the protection of the environment; Establish mechanism for coordinated monitoring, of the environment, in particular mercury use and management.

#### 4.7. Analysis of the Legal and Institutional Frameworks of Eritrea with Regards to the Articles of the Minamata Convention

On the basis of the assessments of the legal and institutional frameworks above, the tables presented in this section link existing national instruments with the provisions of each Article of the Minamata Convention relevant to Eritrea. For each Article, the laws and their relevant content for the Article, the key institutions with their functions considered relevant to the Article and the aspects that need to be improved to fully meet the Article's requirements are presented.

Article 3: Mercury Supply Sources and Trade		
Description of the Article and applicability in the context of Eritrea		
Article No	Succinct summary of provisions of the Article	Applicability
3.3	Not allow new primary mercury mining	Applicable for preventive measures
3.4	Phase out existing primary mercury mining within 15 years	Applicable for preventive measures
3.5(a)	Obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/year	Applicable for preventive measures
3.5(b)	Restrict the use of excess mercury from decommissioning Chlor-alkali plants, and require environmentally sound disposal	Applicable for preventive measures
3.6	Not allow the export of mercury unless the importing country provides written Consent and the mercury is for an allowed use under the convention or environmentally sound storage, and all other conditions of Article 3.6 are met	Applicable for preventive measures
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure	
A Legal Notice to Regulate Mining Operations Legal Notice No. 19/1995	<ul style="list-style-type: none"> <li>• Article 30: a holder of an artisanal mining license is prohibited to use mercury in its mining operations. The Provision reads, 'The holder of an artisanal mining license shall take all environmental protection measures commensurate to his operations; in particular he ... shall not be allowed to use mercury or similar materials in his operation.' This implies that an artisanal gold miner may not import and use mercury whether it is obtained from primary mercury mining or any other sources which is in line with Article 3(4) of the Convention.</li> <li>• Even though, this provision is intended for artisanal miners, it could be inferred from the wording of this provision that this prohibition also applies to the large-scale gold mining activities. It can safely be concluded that generally the use as well as mining of mercury is totally prohibited in Eritrea. This provision is strictly enforced upon the licenced large-scale mining operations and to date it is strictly complied by the holders of such mining license.</li> <li>• Article 31(1)(a)(iii): the Department has the power to request the compliance of a licensee's obligation to "maintain in Eritrea during the term of the license records with regard to weekly changes pertaining to inventories of all minerals produced, stored, treated, transported, exported and sold."</li> </ul>	
The Eritrean Environmental Protection, Management and Rehabilitation Framework Proclamation No. 179/2017	<ul style="list-style-type: none"> <li>• This proclamation does not allow any person to import, export any hazardous and toxic substances without acquiring a written permit from the pertinent authority</li> <li>• Article 32(2): stipulates that, '[t]he production ... of toxic and hazardous chemicals and radioactive substances and their wastes shall be subject to the fulfilment of environmental impact assessment procedures and sound management practices as prescribed by relevant laws or guidelines.'</li> </ul>	
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions		
<ul style="list-style-type: none"> <li>• There is a need for regulatory or policy on mercury import or export.</li> </ul>		

Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions	
Ministry of Energy and Mines (Department of Mines)	<ul style="list-style-type: none"> <li>Prohibits use of Mercury in artisanal mining - equivalent to the elimination of mercury use in the sector.</li> <li>To comply with Article 3(3) of the Convention, this ministry is vested with the power by way of issuing a legislation that denies mining companies from operating a new primary mercury mining as it is the institution which issues all permits and licenses associated with mining operations.</li> <li>As far as the stipulation of Article 3(5)(a) of the Convention is concerned, there is no stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/year in Eritrea. This being the fact, the DoM has the capacity to obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks exceeding 10 MT/year.</li> <li>The Department has the power to request the compliance of a licensee's obligation to 'maintain in Eritrea during the term of the license records with regard to weekly changes pertaining to inventories of all minerals produced, stored, treated, transported, exported and sold.' Moreover, since the Department conducts inspections on and monitors the mining activities within the country, it has the capacity to obtain pertinent information on the stocks and supply of mercury or mercury compounds within Eritrea.</li> </ul>	
Ministry of Land, Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>Institution with the mandate to make sure that mining activities comply with sound and environmentally friendly practices.</li> <li>The DoE requires that every mining operation prepares Social and Environmental Management Plan (SEMP) report before it starts its production activity, a rule which is in line with Article 3(3) of the Convention. This power of the Department is also backed by the proclamation 179/2017 and its legal notice which made the 1999 National Environmental Assessment Procedures and Guidelines (NEAPG), a binding guideline. In compliance to this mandate, the DoE conducts routine monitoring and inspection at the mining sites. If it identifies that any mining activity seems to have a significant impact upon the environment, it denies giving the project an environmental clearance certificate a pre-requisite for any project to commence conducting its activities.</li> <li>Currently, Eritrea is not threatened to the extent that it needs to comply with all the conditions specified under Article 3(6) of the Convention which deal with the export of mercury or mercury compounds. However, the DoE has the capacity to request the importing country to provide written Consent and the mercury is for an allowed use under the Convention or environmentally sound storage.</li> </ul>	
Ministry of Agriculture	<ul style="list-style-type: none"> <li>There was limited amount of mercury added products within the stock of the Ministry of Agriculture. However, the products were disposed and do not exist in their stock any more. The Ministry could obtain the desired information in compliance to Article 3(5)(a) of the Convention by consulting the records of the inventory of the various pesticides or fungicides it has in the warehouses of the Ministry. However, it should be noted that there is no stock of mercury or mercury added products that reaches to the amount provided under this Article of the Convention.</li> </ul>	
Department of Customs (DoC)	<ul style="list-style-type: none"> <li>Under the Import Duty regulation, it is provided that the amount of tax that is levied upon mercury is 2%. This tariff is set internationally. If the amount of taxation for importation of mercury is determined, then the DoC can obtain from its records about the desired information on how much mercury was imported which could provide an estimate of the amount of mercury that has entered into the country.</li> <li>Mercury is one of the items that need to be declared to be imported. Currently, mercury is not included under the list of banned/prohibited chemicals to be imported into Eritrea. This list is issued by the DoE of the MoLWE, making the DoC as the executing organ in the controlling the chemicals that are imported into the country. Hence, any person who wants to import mercury needs to declare it to the DoE and DoC before it is exported from the country of export.</li> </ul>	
Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met		
<ul style="list-style-type: none"> <li>The capacity gap of the DoM is that, since the only way that the artisanal miners could obtain mercury is by smuggling it into the country, it is very difficult for the Department or any other government institution to take effective preventive measures over the artisanal miners not to import and use mercury in their mining activities.</li> <li>For the purpose of Article 3(4) of the convention, the introduction of mercury free technologies in the ASGM sector by the Ministry of Energy and Mines might help to prevent the import and use of mercury in the ASGM sector.</li> <li>Furthermore, the DoE doesn't have the relevant capacity to comply with the responsibilities that are stipulated under Article 3(4) of the convention, especially, with respect to the illegally imported hazardous or toxic substances.</li> </ul>		
<b>Article 4: Mercury-Added Products</b>		
Description of the Article and applicability in the context of Eritrea		
Article No	Succinct summary of provisions of the Article	Applicability
4.1	Not allow the manufacture, import, and export of products listed in Part I of Annex A not otherwise excluded following the phase out date listed in the Annex	Applicable
4.3	Phase down the use of dental amalgam through two or more measures listed in Part II of Annex A	Applicable
4.5	Take measures to prevent the incorporation of products listed in Part I of Annex A (i.e., switches and relays, batteries) into larger, assembled products	Applicable.
4.6	Discourage the manufacture and distribution of new mercury product types	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure	
A legal notice published on the Haddas Eritrea newspaper dated 06/05/2006 number 213	8. The MoTI requests an approval from the concerned sector whether any given product is allowed or not to enter (to be imported) into the country.	

<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions</p> <ul style="list-style-type: none"> <li>• Elaborate specific policy/legal instrument that governs the importation, administration and proper use of mercury or mercury added products.</li> <li>• Elaborate a legislation to address some issues such as phasing-down dental amalgam.</li> <li>• Update national laws to prohibit the manufacture, trade, supply, import or export of mercury and mercury-added products explicitly.</li> <li>• Update Customs legislation on import tax and mercury-added products imported</li> <li>• Develop a separate legislation on mercury use to prohibit the manufacture, import, and export of products listed in Part I of Annex A.</li> </ul>		
<p><b>Name of the Institution/stakeholder and its role with respect to the above-listed provisions</b></p>		<p><b>Relevant institutional capacity in place to comply with the above listed provisions</b></p>
<p>Ministry of Trade and Industry (Eritrean Standards Institution)</p>		<ul style="list-style-type: none"> <li>• Responsible government institution which approves the manufacture, import and export of any products.</li> <li>• In accordance with Article 4(1) of the Convention, the Ministry of Trade and Industry generally prohibits or does not allow the manufacture, importation or exportation of any products that are hazardous to human health and the environment. For the Department to reach to such decision, the Eritrean Institution of Standards has to determine whether any product that is to be manufactured within, imported into and exported from Eritrea complies with the standards set by the Institution.</li> </ul>
<p>Department of Customs (Ministry of Finance)</p>		<ul style="list-style-type: none"> <li>• The Department of Customs is an implementing organ of the Ministry of Finance as well as for any other government institutions which set the amount of importation duty levied on various items or products that are allowed to be imported into Eritrea. If there is a prohibition passed upon the importation of any item or product, the Department has the power to cease and confiscate such item or product at the officially designated points of entry and exit, such as: ports, airports and border check points.</li> </ul>
<p>Ministry of Health (MoH)</p>		<ul style="list-style-type: none"> <li>• Government institution that operates a considerable number of health services providing facilities across the country and the private dental clinics which either use, emit, or release mercury compounds and mercury containing products.</li> <li>• There is no specific institutional capacity in place that is intended to comply with Article 4(3) of the Convention. However, the Ministry conducts check-ups of the dental health of elementary school students and dispenses toothpastes and brushes to all students to foster the behaviour of keeping their teeth clean and thereby prevent their tooth from decay starting from their early age. This is the only capacity that the Ministry possess which is in line with measures provided under paragraph I of Annex A Part II that aims at dental caries prevention and health promotion, to minimize the need for future dental restoration by members of the society.</li> </ul>
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p> <ul style="list-style-type: none"> <li>• Basically, there is no manufacturing or exportation of mercury added products mentioned under Annex A of the Convention from Eritrea.</li> <li>• For the importation of mercury added products, since there is no national legislation, or standard and guideline prepared which limits the importation of designated mercury added products or sets the roles and responsibilities of the various pertinent government institutions, it is difficult to control the importation of the items that are listed under Annex A of the Convention.</li> <li>• The absence of any accredited national laboratories is one of the gaps that is faced at the national level to identify the level of mercury content in a given product.</li> </ul>		
<p align="center"><b>Article 6: Exemptions available to a Party upon request</b></p>		
<p>Description of the Article and applicability in the context of Eritrea</p>		
<p><b>Article No</b></p>	<p><b>Succinct summary of provisions of the Article</b></p>	<p><b>Applicability</b></p>
<p>6.1</p>	<p>Any State or regional economic integration may register for one or more exemptions from the phase-out dates listed in Annex A and Annex B</p>	<p>Applicable</p>
<p>Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions</p>		
<p><b>Title, ref. no. and date of relevant Policy and Regulatory Measure</b></p>	<p><b>what aspects of the above provisions are being addressed by policy/regulatory measure</b></p>	
<p>No relevant policy and regulatory measure.</p>	<p>Not applicable</p>	
<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions</p>		
<p><b>Name of the Institution/stakeholder and its role with respect to the above-listed provisions</b></p>		<p><b>Relevant institutional capacity in place to comply with the above listed provisions</b></p>
<p>Ministry of Land, Water and Environment</p>		<ul style="list-style-type: none"> <li>• After due consideration and assessment of the socio-economic development of the country and in consultation with the pertinent government institutions, this Ministry may register for one or more exemptions for items that are listed under Annex A and B from their phase out date. The Ministry of Land, Water and Environment, through the Department of Environment, has the relevant institutional capacity to determine the exemptions and register them with the secretariat.</li> </ul>
<p>Ministry of Energy and Mines (Department of Energy)</p>		<ul style="list-style-type: none"> <li>• The Department of Energy of the Ministry of Mines and Energy in collaboration with and in consultation with the pertinent private as well as government institutions may recommend the phase out date for the products that are listed under Part I of Annex A taking into consideration current needs of the country over those products that are listed under annex A which are currently pertinent to the Eritrean reality. The MOEM has the relevant capacity to make such determination and provide the MoLWE with the list of the products that need registration for their exemption and the reason for such exemption.</li> </ul>
<p>Ministry of Health (the MoH)</p>		<ul style="list-style-type: none"> <li>• The MoH can assess the capacity of the dental clinics in the country whether owned by the government or those that are run privately and recommend to the MoLWE for the exemption of the phase-out date of the use of mercury for dental fillings based on the capacity of the dental clinics in the country to introduce mercury free dental filling techniques or any other alternatives.</li> </ul>
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p>		

**Article 7: Artisanal and Small-scale Gold Mining (ASGM)**

**Description of the Article and applicability in the context of Eritrea**

Article No	Succinct summary of provisions of the Article	Applicability
7.1 to 7.4 and Annex C	<ul style="list-style-type: none"> <li>Take measures to reduce, and where feasible, eliminate mercury and mercury compound use, emissions (to air), and releases (to land and water) associated with ASGM</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Establish coordinating mechanism and delineate agency roles for development/implementation of an ASGM National Action Plan (NAP)</li> <li>Where applicable define and formalize or regulate ASGM consistent with the Convention</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Eliminate whole ore amalgamation, open burning of amalgam or processed amalgam, burning of amalgam in residential areas, and cyanide leaching of mercury-laden sediment, ore or tailings (the “worst practices”)</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Set mercury use reduction goals or targets consistent with the timely elimination of the worst practices and other use reduction efforts</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Develop steps to facilitate the formalization or regulation of the artisanal and small-scale gold mining sector</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Develop strategies to prevent the exposure of vulnerable populations, particularly children and women of child-bearing age, especially pregnant women, to mercury used in artisanal and small-scale gold mining;</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Reduce mercury emissions, releases, and exposures associated with ASGM, and prevent mercury exposures of vulnerable populations (particularly women of child-bearing age and children)</li> </ul>	Applicable
	<ul style="list-style-type: none"> <li>Strategies for managing trade and preventing the diversion of mercury and mercury compounds from other sectors to ASGM, and manage mercury trade consistent with the NAP</li> <li>Implement a public health strategy to address mercury exposures to ASGM miners and communities</li> </ul>	Applicable

Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions

Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure
The Eritrean Environmental Protection, Management and Rehabilitation Framework Proclamation No. 179/2017	<ul style="list-style-type: none"> <li>Provides that “Every person shall have the duty to prevent or control pollution and shall not discharge or emit or allow the discharge or emission of any effluent, gases, or solid waste in amounts that would harm the health and wellbeing of humans, plants and animals, microbial species, ecosystems, water resources, soil, air or human settlements.” Furthermore, Article 33(1) of the same provides that “Every person, whose activities generate waste, shall have the duty to responsibly manage the waste and apply necessary measures to minimize it as required by this Proclamation and any other related laws and regulations.”</li> </ul>
Environmental Protection and Management Regulations Legal Notice No.127 /2017	<ul style="list-style-type: none"> <li>Under Article 12(1) stipulates that “No person shall carry out any project or activity, which is likely to discharge effluents or emissions to the environment in excess of the amount declared acceptable by applicable standards or guidelines.”</li> </ul>
Article 30(6) Of Legal Notice No.19/1995 Regulations On Mining Operations	<ul style="list-style-type: none"> <li>States that “The holder of an artisanal mining license shall take all environmental protection measures commensurate to his operations: in particular he [...] shall not be allowed to use mercury or similar materials in his operation.”</li> </ul>

Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention’s provisions

- Not in conformity with Minamata regarding the elimination of mercury and mercury compound use in ASGM. Hence, the policy and regulatory mechanisms need to be adjusted and further developed to comply with the convention.
- A special provision for mercury management need to be incorporated as part of the existing/upcoming chemicals related national legislation.

Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions
Ministry of Land Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>Adequate and general - provide comprehensive legal framework for the protection of the environment</li> </ul>
Ministry of Energy and Mines (Department of Mines)	<ul style="list-style-type: none"> <li>Prohibits use of Mercury in artisanal mining - equivalent to the elimination of mercury use in the sector. Even though, the role of enforcing the laws is a matter that is executed by the administrative divisions of the Local Governments and the law enforcement agencies, the MoEM can give professional-guidance and monitoring as to how the letters of the law have to be implemented through these institutions.</li> </ul>

Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met

- Despite the fact that there are legislations passed by DoE of the Ministry of Land, Water and Environment as well as the DoM of the MoEM, these institutions have not taken measures to reduce, or eliminate mercury and mercury compound use, emissions and releases associated.



### Article 8: Emissions

#### Description of the Article and applicability in the context of Eritrea

Article No	Succinct summary of provisions of the Article	Applicability
8.4	Require Best Available Techniques/Best Environmental Practices (BAT/BEP) or associated emission limit values (ELVs) for new (as defined in Article 8.2(c)) sources listed in Annex D (coal-fired power plants, coal-fired industrial boilers, non-ferrous metal smelting and roasting processes, waste incineration, and cement production)	Applicable
8.5	Require one or more measures identified in Article 8.5 to control/reduce mercury emissions from existing sources listed in Annex D, which shall be operational at the source within 10 years	Applicable
8.7	Require monitoring/reporting and other wise establish a mercury emissions inventory for sources listed in Annex D	Applicable

Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions

Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure
Proclamation No.179/2017	Provides that “Every person shall have the duty to prevent or control pollution and shall not discharge or emit or allow the discharge or emission of any effluent, gases, or solid waste in amounts that would harm the health and wellbeing of humans, plants and animals, microbial species, ecosystems, water resources, soil, air or human settlements.” Furthermore, Article 33(1) of the same provides that “Every person, whose activities generate waste, shall have the duty to responsibly manage the waste and apply necessary measures to minimize it as required by this Proclamation and any other related laws and regulations.”
Ministry of Health (MoH)	The Ministry of Health (MoH) is responsible for the sound management of public health. It administers most of the hospitals in the country. Mercury is used in hospitals, health centres and medical laboratories, dental clinics, as well as medical equipment such as in thermometers. The hospitals emit mercury to the atmosphere from the medical wastes they incinerate which includes chemical wastes, pathological wastes, and highly infectious wastes.

Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention’s provisions

- No environmental land pollution and protection, nor that of mercury management.
- A special provision for the application of BAT/BEP in the management of mercury need to be incorporated as part of the existing /upcoming chemicals related national legislation.

Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions
Ministry of Land Water and Environment (Department of Environment)	The Department of Environment has the capacity to require the installation of emission control technologies to plants which emit mercury or any other pollutants to the environment. The Department also regulates big project, especially the large-scale mining activities in the country, to limit their emission level not to exceed the permissible level.
Ministry of Health (MoH)	The Ministry of Health has the capacity to introduce in the various health care facilities medical waste incinerators with the proper mercury emission control equipment if adequate funds are allocated for such purpose.
Ministry of Energy and Mines (MoEM)	Has the capacity to issue a legislation which requires plants to use emission control technologies.

Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met

- Lack of adequate, detailed and specific regulations, rules, procedures, standards, techniques, practices, limit values, inventory, and manuals to put into effect the said environmental policies, laws and regulations

### Article 9: Releases to Land and Water

#### Description of the Article and applicability in the context of Eritrea

Article No	Succinct summary of provisions of the Article	Applicability
9.3, 9.6	Require reporting or otherwise obtain information as needed to identify significant sources of mercury/mercury compound releases to land or water, and to maintain an inventory of releases from the sources identified	Applicable
9.5	Take one or more measures specified in Article 9.5 to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies	Applicable

Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions

- No specific legislation on this issue

Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure	
Land Law Proclamation No. 58/1994	Land law does not address pollution from mercury use.	
Article 3 of the Water Proclamation No. 162/2010	<p>The objective of the Water Proclamations “ensuring that the water resources of the country are utilized in a sustainable manner[...] through conservation and protection from pollution and related risk factors of the country’s water resources; [...] promotion of public awareness and participation in water conservation, protection and management [...]”.</p> <p>The objective of the Water Proclamations “ensuring that the water resources of the country are utilized in a sustainable manner[...] through conservation and protection from pollution and related risk factors of the country’s water resources; [...] promotion of public awareness and participation in water conservation, protection and management [...]”.</p> <p>This Proclamation also provides that “The Ministry of Land, Water and Environment (MoLWE) shall not grant permit without prior submission of environmental impact assessment.”<sup>122</sup> and obliges “the Minister [to] ensure and monitor the implementation of the water proclamation, in particular, [to] ensure that the desired water quality standard is maintained and all water-related bodies and structures receive due protection against pollution, contamination and physical damage.”<sup>123</sup> This proclamation provides for the protection of water resources against direct or indirect pollution and abatement.<sup>124</sup> Furthermore, the Minister shall, in consultation with pertinent authorities, set standards and prescribe guidelines for water quality, including potable water, irrigational, industrial and other different uses of water, water desalination and water supply service suppliers.</p>	
<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention’s provisions</p> <ul style="list-style-type: none"> <li>No environmental land pollution standards and protection measures, including mercury releases.</li> <li>Elaborate a legislation for controlling releases in water and land</li> <li>A separate legislation on mercury use should be developed to provide for access to information of significant sources of mercury release, maintain inventory of such release and control/reduce mercury/mercury compound release to land and water.</li> </ul>		
Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions	
Department of Water	The Department’s laboratory is equipped with adequate laboratory equipment to conduct chemical analysis in water.	
Ministry of Agriculture	The NARI and NAPHL are equipped with adequate laboratory equipment to conduct chemical analysis of soil and water.	
Ministry of Marine Resources	This Ministry has a state of the art laboratory equipment to identify any chemical content in marine and any aquatic products by conducting sample analysis.	
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p> <ul style="list-style-type: none"> <li>Gaps in standards, procedures, technique, and control mechanism of the release of mercury or mercury compounds to land and water.</li> </ul>		
Article 10: Environmentally sound interim storage of mercury, other than waste mercury		
Description of the Article and applicability in the context of Eritrea		
Article No	Succinct summary of provisions of the Article	Applicability
10.2	Take measures to ensure interim mercury storage is conducted in an environmentally sound manner, taking into account guidelines to be developed by the Conference of the Parties (COP)	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure	
Article 32(2) of The Eritrean Environmental Protection, Management and Rehabilitation Framework-Proclamation No. 179/2017	<ul style="list-style-type: none"> <li>Provides that “The production, storage, sale, distribution, import, export and transit of toxic and hazardous chemicals and radioactive substances and their wastes shall be subject to the fulfilment of environmental impact assessment procedures and sound management practices as prescribed by relevant laws or guidelines.”</li> </ul>	
Article 10 Legal Notice No. 114/2016 A Regulation for Importation, Handling, Use, Storage and Disposal of Pesticide <sup>125</sup>	<ul style="list-style-type: none"> <li>Provides that: “Regular inspection activities [to] be carried out by the Ministry of Agriculture in pesticide stores and premises as well as during pesticide application to ensure that pesticides are properly stored and applied and [to] assess the condition of the pesticides in order to take the necessary measure. ”Furthermore, “The Ministry may in collaboration with concerned institutions make every effort to ensure the safe disposal of obsolete pesticides.”.</li> </ul>	
<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention’s provisions</p> <ul style="list-style-type: none"> <li>Though Eritrea has no stocks of mercury (storage) and, as mercury is part of hazardous chemicals, it can be provided for in the upcoming chemicals/hazardous waste legislation.</li> <li>Laws are not adequate enough to ensure that measures of interim mercury storage (Article 10 Minamata) are undertaken in an appropriate manner and nor comprehensive</li> <li>Legal gaps that need urgent attention and actions</li> </ul>		
Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacities in place to comply with the above listed provisions	
Ministry of Land Water and Environment (Department of Environment)	The Department of Environment conducts routine and timely EIA on the chemical storage facilities of various institutions.	
Ministry of Agriculture	The Ministry of Agriculture had obsolete mercury added pesticide, but all these mercury added pesticide were safeguarded with the obsolete pesticides. So now there is no mercury added pesticide in stores of MoA.	
Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met		

122- Article 8 of Proclamation No. 162/2010.

123- Article 10 of Proclamation No. 162/2010.

124- Article 14 and 15 of Proclamation No. 162/2010.

125- “A Regulation for Importation, Handling, Use, Storage and Disposal of Pesticide, issued by the Gazette of Eritrean Laws, Vol. 15/2016, No. 5, Asmara, December 18, 2016”.

### Article 11: Mercury Wastes

#### Description of the Article and applicability in the context of Eritrea

Article No	Succinct summary of provisions of the Article	Applicability
11.3 (a)	Take measures to manage mercury wastes in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirements to be developed.	Applicable
11.3 (b)	Take measures to restrict mercury derived from the treatment or re-use of mercury waste to allowed uses under the Convention or environmentally sound disposal	Applicable
11.3 (c)	Require transport across international boundaries in accordance with the Basel Convention, or if the Basel Convention does not apply, consistent with international rules, standards, and guidelines	Applicable

Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions

Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure
Article 32(2) of Proclamation 179/2017-The Eritrean Environmental Protection, Management and Rehabilitation Framework	Provides that “The production, storage, sale, distribution, import, export and transit of toxic and hazardous chemicals and radioactive substances and their wastes shall be subject to the fulfilment of environmental impact assessment procedures and sound management practices as prescribed by relevant laws or guidelines.”
Article 10 Legal Notice No. 114/2016 A Regulation for Importation, Handling, Use, Storage and Disposal of Pesticide	Provides that: “The Ministry may in collaboration with concerned institutions make every effort to ensure the safe disposal of obsolete pesticides.”

Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention’s provisions

- Finalize the draft regulation of hazardous waste and others should be adequate for the sound management of mercury.

Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions
Ministry of Land Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>With respect to Article 11(3)(c) of the Minamata Convention, despite the fact that the Department has not yet promulgated the draft legislation that is applicable to this Article, it does not allow any person to transport hazardous or other wastes through the territory of the State of Eritrea including through its territorial waters, contiguous zone, exclusive economic zone and air space without obtaining appropriate permits and prior consent of the Department.</li> </ul>

Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met

- The institutional capacity in respect to this Article of the Convention is almost non-existent. The only measure that has been taken by the DoE of the MoLWE is that it has prepared a draft legislation that is pertinent to the application of the Basel Convention.
- Because this draft legislation has not been promulgated yet the DoE has not been able to establish the relevant institutional capacity.
- There is no waste segregation mechanism in place which makes it difficult to easily identify and manage the mercury containing wastes in an environmentally sound manner.

### Article 12: Contaminated Sites

#### Description of the Article and applicability in the context of Eritrea

Article No	Succinct summary of provisions of the Article	Applicability
12.1	Develop strategies for identifying and assessing mercury/mercury compound contaminated sites	Applicable
12.2	If risk reduction activities are taken at contaminated sites, they are taken in an environmentally sound manner, incorporating risk assessment where appropriate	Applicable

Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions

Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure
The Eritrean Environmental Protection, Management and Rehabilitation Framework Proclamation No. 179/17	Articles 33 and 34 impose a duty on every person to manage and minimize waste including the prohibition of import/export of waste.
The Environmental Protection and Management Regulations Legal Notice No. 127/17	Articles 11, 12, 13 and 14 establish efficient waste management systems and safe dumping sites; regulation of effluents and emissions; regulation of radioactive substances; and management and handling of hazardous wastes including mercury.

Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention’s provisions

- Elaborate measures for identifying and assessing contaminated sites, including mercury and mercury compounds contaminated sites

Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions
Ministry of Land Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>To comply with Article 12(1) of the Convention, the DoE has so far not developed any strategy. However, with the progresses this project, strategies will be developed for the identification and assessment of mercury or mercury compound contaminated sites.</li> </ul>

Ministry of Energy and Mines (Department of Mines)	<ul style="list-style-type: none"> <li>The DoM has once conducted mercury contamination assessment at Department level on mines from the Italian colonial era as well as from ASGM activities.</li> </ul>	
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p> <ul style="list-style-type: none"> <li>After the assessment that was conducted initially by the DoM of the MoEM, it has not conducted any further assessment of the same kind. The discontinuance of the assessment is because the Department does not have the relevant capacity to comply with this responsibility due to financial barriers.</li> </ul>		
<b>Article 13: Financial Resources and Mechanism</b>		
<b>Description of the Article and applicability in the context of Eritrea</b>		
<b>Article No</b>	<b>Succinct summary of provisions of the Article</b>	<b>Applicability</b>
13.1	Access domestic resources as may be needed to implement Convention obligations	Applicable
13.2	Access financial resources available under the Convention financial mechanism and other resources available from multilateral, regional, and bilateral funding sources	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
<b>Title, ref. no. and date of relevant Policy and Regulatory Measure</b>	<b>What aspects of the above provisions are being addressed by policy/regulatory measure</b>	
The Eritrean Environmental Protection, Management and Rehabilitation Framework Proclamation No. 179/17	<p>Article 23: National Environment Fund (NEF)</p> <p>(1) A special National Environment Fund, that shall be used for projects designed to protect, conserve, restore and enhance the environment, including to develop human and institutional capacity needed for the proper management of the environment, shall be established.</p> <p>(2) The sources of the NEF may include:</p> <ul style="list-style-type: none"> <li>(a) the State treasury contribution;</li> <li>(b) Voluntary contribution from nationals, individuals and or organizations; and</li> <li>(c) Contribution from international and other foreign partners.</li> </ul>	
Specific International Program	Funding Program for capacity building and technical assistance to meet the requirements of the Minamata Convention.	
Special International Program	Funding Program for legal and institutional capacity building to meet the requirements of the Basel, Rotterdam and Stockholm Conventions as well as the Minamata Convention and SAICM	
Special International Program	<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions</p> <ul style="list-style-type: none"> <li>Some policy or legislation should be developed to promote access to domestic, regional or international resources for the implementation of Convention provisions.</li> </ul>	
The Minamata Secretariat	<ul style="list-style-type: none"> <li>Ensure compliance with the Articles of the Convention by the Parties</li> <li>Host the International Specific Program and ensure the distribution of funds</li> <li>Ensures cohesion in the preparation of projects and can provide information on the meaning of the Articles and Annexes of the relevant Convention</li> </ul>	
Ministry of Land Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>The department has access to the financial resources available under the Convention financial mechanism and other available sources.</li> </ul>	
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p> <p>The Department of Environment needs a continuous and adequate financial funding from the Global Environment Facility (GEF) Trust Fund and other international donors to implement the Convention since the Department runs its activities solely on government allocated budget which might not be sufficient to cover costs to implement the obligations of the Convention.</p>		
<b>Article 14: Capacity-building, technical assistance and technology transfer</b>		
<b>Description of the Article and applicability in the context of Eritrea</b>		
<b>Article No</b>	<b>Succinct summary of provisions of the Article</b>	<b>Applicability</b>
14.2	Capacity-building and technical assistance pursuant to article 14.1 and Article 13 may be delivered through regional, sub-regional and national arrangements, including existing regional and sub-regional centres, through other multilateral and bilateral means, and through partnerships, including partnerships involving the private sector.	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
<b>Title, ref. no. and date of relevant Policy and Regulatory Measure</b>	<b>What aspects of the above provisions are being addressed by policy/regulatory measure</b>	
The Eritrean Science and Technology Development Agency (ESTDA) Establishment Proclamation No. 122/2002.	<p>The Eritrean Science and Technology Development Agency's (ESTDA) objectives are:</p> <ul style="list-style-type: none"> <li>- Under Article 2, to Promote and coordinate the application of science and technology in the overall development of the country under the guidance of National Science and Technology Council (NSTC) established;</li> <li>- Under Article 6, to build up national capability for research and development of science and technology,</li> <li>- Under Article 7, establish science and technology research and development institutions, science and technology service institutions, science and technology education institutions, science and technology research foundations.</li> </ul> <p>The issue of exerting and coordinating efforts in the fight against mercury pollution partially depends on using latest know-how and advanced laboratories which are oriented by the above-mentioned science and technology policy</p>	



Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions The Eritrean Science and Technology Development Agency needs to be established in order to oversee the development of research and capacity building.		
<b>Name of the Institution/stakeholder and its role with respect to the above-listed provisions</b>	<b>Relevant institutional capacity in place to comply with the above listed provisions</b>	
Ministry of Land Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>The MoLWE through the DoE conducts various capacity building programs to its staff and other relevant sectors on various areas of interest that is under its mandate and is working upon.</li> </ul>	
Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met		
<ul style="list-style-type: none"> <li>The capacity building effort of the MoLWE is limited to environmental issues other than those concerning Mercury. However, the MoLWE is willing to engage with regional and sub-regional centres which could provide capacity-building and technical assistance that could be delivered through regional, sub-regional and national arrangements whether it is through multilateral or bilateral means provided that it is made based on mutual understanding.</li> </ul>		
<b>Article 16: Health Aspects</b>		
<b>Description of the Article and applicability in the context of Eritrea</b>		
<b>Article No</b>	<b>Succinct summary of provisions of the Article</b>	<b>Applicability</b>
16.1(a)	Promote the development and implementation of strategies to identify and protect populations at risk, such as developing fish consumption guidelines	Applicable
16.1(b)	Promote occupational exposure educational and prevention programs	Applicable
16.1(c)	Promote prevention, treatment, and care services for affected populations	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
<b>Title, ref. no. and date of relevant Policy and Regulatory Measure</b>	<b>What aspects of the above provisions are being addressed by policy/regulatory measure</b>	
National Health Policy of 2010	National Health Policy objective is to improve and safeguard the health of citizens.	
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions		
<ul style="list-style-type: none"> <li>Update the National Health Policy of 2010 for addressing health issues directly</li> <li>Serious gaps in the legal framework</li> <li>No strategies to identify and protect populations at risk from mercury and mercury compound use</li> <li>No prevention, treatment and care services for mercury affected populations, and</li> <li>Elaborate appropriate measures for regulating Private dental clinics use dental amalgams</li> </ul>		
<b>Name of the Institution/stakeholder and its role with respect to the above-listed provisions</b>	<b>Relevant institutional capacity in place to comply with the above listed provisions</b>	
Ministry of Health (MoH)	The Ministry of health has various levels of health facilities across the country which is available for the public within the distance of 5-10 km. This capacity of the Ministry coupled with a strategy developed to tackle mercury related health care activities are likely to be as effective as the successes achieved by the Ministry in the fight against the reduction or elimination of a number of health related problems such as malaria, child mortality, maternal mortality etc.	
Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met		
<ul style="list-style-type: none"> <li>For the purpose of sub-Article 16(1)(b) and (c) of the Convention, if the affected population are workers (employees), the Ministry of Labour and Social Welfare provides the necessary management plan which is in line with the draft national occupational safety and health standards. Nevertheless, the Ministry does not have a capacity to comply with this responsibility; because, the standard is until now available only in a draft form.</li> </ul>		
<b>Article 17: Information Exchange</b>		
<b>Description of the Article and applicability in the context of Eritrea</b>		
<b>Article No</b>	<b>Succinct summary of provisions of the Article</b>	<b>Applicability</b>
17.1, 17.3 and 17.5	Each party shall facilitate the exchange of information referred to in paragraph 17.1. Each Party shall designate a national focal point for the exchange of information under this Convention. Share information on the health and safety of humans and the environment as non-confidential, in accordance with Article 17.5	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
<b>Title, ref. no. and date of relevant Policy and Regulatory Measure</b>	<b>What aspects of the above provisions are being addressed by policy/regulatory measure</b>	
UNDAF, SPCF, 10th EDF, and other development assistance Programs	Information shared from different projects and researches.	
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions		
<ul style="list-style-type: none"> <li>Eritrea should make an informed decision to consider ratification of the Convention through the proper channel.</li> </ul>		
<b>Name of the Institution/stakeholder and its role with respect to the above-listed provisions</b>	<b>Relevant institutional capacity in place to comply with the above listed provisions</b>	
Ministry of Land Water and Environment (Department of Environment)	This ministry is compliant to the provisions of the Convention since it shares information by way of implementation of various projects which shows that the ministry passes relevant information to the partners and donors of the projects	
Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met		

<b>Article 18: Public information, awareness and education</b>		
<b>Description of the Article and applicability in the context of Eritrea</b>		
<b>Article No</b>	<b>Succinct summary of provisions of the Article</b>	<b>Applicability</b>
18.1	shall promote and facilitate provision to the public of available information referred to in paragraph 18.1 and education, training and public awareness related to the effects of exposure to mercury and mercury compounds on human health and the environment	Applicable
18.2	shall use existing mechanisms or give consideration to the development of mechanisms, such as pollutant release and transfer registers where applicable, for the collection and dissemination of information on estimates of its annual quantities of mercury and mercury compounds that are emitted, released or disposed of through human activities.	Application
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		
<b>Title, ref. no. and date of relevant Policy and Regulatory Measure</b>	<b>What aspects of the above provisions are being addressed by policy/regulatory measure</b>	
The Press Proclamation NO 90/1996	The Press Proclamation No. 90/1996 which provides a legal framework for freedom of press and information within Eritrea has the potential to be a major facilitator of the dissemination of mercury related health issues and information.	
Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions		
<b>Name of the Institution/stakeholder and its role with respect to the above-listed provisions</b>	<b>Relevant institutional capacity in place to comply with the above listed provisions</b>	
Ministry of Land Water and Environment (Department of Environment)	<ul style="list-style-type: none"> <li>Under the Department of Environment, there is an Awareness and Information Division. This division conducts seminars at schools, colleges and various communities in the different regions of the country on several environmental issues.</li> <li>With respect to Article 18(2) of the Convention, there is no specific legislation that addresses mercury related registration mechanism in place. There is, however, a legislation and the necessary capacity to develop the registration mechanism applicable to general hazardous wastes that are covered under the Basel Convention which requires any person engaged in activities related to the collection, storage, transportation and disposal of hazardous wastes to maintain a register showing a record of the quantity, category, quality and origin and other information related to the management of the hazardous wastes or other wastes. And the person who prepares such a register must provide to the Department every year with such information related to the previous year.</li> </ul>	
Ministry of Information (MoI) and Ministry of Education (MoE)	<ul style="list-style-type: none"> <li>The Ministry of Information in collaboration with the DoE can broadcast public awareness programs on the national radio and television channels as well as publish in the three different Eritrean languages (Tigre, Tigrigna and Arabic) Article on the official newspapers that are related to the effects of exposure to mercury and mercury compounds and their effect on human health and the environment.</li> </ul>	
Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met		
<ul style="list-style-type: none"> <li>Lack of transportation facilities to accesses remote areas.</li> <li>Limited human resources.</li> <li>Inadequate fund to finance the different awareness campaigns</li> <li>In sufficient materials that could be used to transfer the information to the public such as, overhead projectors, laptops etc.</li> </ul>		
<b>Article 19: Research, Development and Monitoring</b>		
<b>Description of the Article and applicability in the context of Eritrea</b>		
<b>Article No</b>	<b>Succinct summary of provisions of the Article</b>	<b>Applicability</b>
19.1	shall endeavour to cooperate to develop and improve, (a) Inventories of use, consumption, and anthropogenic emissions to air and releases to water and land of mercury and mercury compounds; (b) Modelling and geographically representative monitoring of levels of mercury and mercury compounds in vulnerable populations and ecosystems, (c) Assessments of the impact of mercury and mercury compounds on human health and the environment;(d) Harmonized methodologies for the activities undertaken under subparagraphs (a), (b) and (c);(e) Information on the environmental cycle, transport, transformation and fate of mercury and mercury compounds in a range of ecosystems	Applicable
19.2	build on existing monitoring networks and research Programs in undertaking the activities identified in paragraph 19.1.	Applicable
Policy and regulatory measures in place that enable Eritrea to comply with the above listed provisions		

Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure
<p>The Eritrean Science and Technology Development Agency (ESTDA) Establishment Proclamation No. 122/2002.</p>	<p>The Eritrean Science and Technology Development Agency's (ESTDA) objectives are:</p> <ul style="list-style-type: none"> <li>- Under Article 2, to Promote and coordinate the application of science and technology in the overall development of the country under the guidance of National Science and Technology Council (NSTC) established;</li> <li>- Under Article 6, to build up national capability for research and development of science and technology;</li> <li>- Under Article 7, establish science and technology research and development institutions, science and technology service institutions, science and technology education institutions, science and technology research foundations.</li> </ul> <p>The issue of exerting and coordinating efforts in the fight against mercury pollution partially depends on using latest know-how and advanced laboratories which are oriented by the above-mentioned science and technology policy</p>
<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions</p> <ul style="list-style-type: none"> <li>• Render the Science and technology legislation functional and necessary regulations for its effective implementation should be developed to promote research, development and monitoring.</li> </ul>	
Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions
<p>The Eritrean Science and technology Development Agency</p>	<p>This agency has not been established yet.</p>
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p> <ul style="list-style-type: none"> <li>• The ministry of land water and environment has limited capacity to conduct the above-mentioned activities in Article 19.1(a)</li> <li>• The Eritrean Science and Technology Development Agency needs to be established in order to conduct any research, development and monitoring activities.</li> </ul>	
Article 21	
Description of the Article and applicability in the context of Eritrea	
<p>21.1</p>	<p>shall report to the Conference of the Parties, through the Secretariat, on the measures it has taken to implement the provisions of this Convention and on the effectiveness of such measures and the possible challenges in meeting the objectives of the Convention</p> <p style="text-align: right;">Applicable</p>
<p>21.2</p>	<p>shall include in its reporting the information as called for in Articles 3, 5, 7, 8 and 9 of this Convention</p> <p style="text-align: right;">Applicable</p>
Title, ref. no. and date of relevant Policy and Regulatory Measure	What aspects of the above provisions are being addressed by policy/regulatory measure
<p>Outstanding regulatory or policy aspects that would need to be addressed/developed to ensure compliance with the Convention's provisions</p>	
Name of the Institution/stakeholder and its role with respect to the above-listed provisions	Relevant institutional capacity in place to comply with the above listed provisions
<p>Ministry of Land Water and Environment</p>	<p>This ministry has the relevant institutional reporting capacity. However, the reporting of the measures it has taken to implement the provisions of the Minamata Convention and on the effectiveness of such measures is a matter that is to be dealt with once Eritrea is a party to the Convention.</p>
<p>Remaining Capacity Gaps at National Level that need to be addressed before provisions can be met</p>	

# 5. AWARENESS RAISING AND UNDERSTANDING OF WORKERS AND THE PUBLIC

## 5.1 Introduction

The Human health and Environmental risks associated with exposure to mercury and mercury emission/releases is critical and a global concern. High risk coming from uncontrolled exposure to mercury and mercury added products should be understood by everyone. The mercury inventory conducted as part of this MIA preparation revealed that the amount of mercury inputs from various sources to the environment is not insignificant. Most of the unintentional mercury emissions/release in the country comes from, Gold extraction by methods other than mercury amalgamation (4538 kg Hg/y), Gold extraction with mercury amalgamation from concentrated ore (204 kg. Hg/y) and Informal dumping of general waste and informal waste burning are (529 kg Hg/y). Individual exposure to the emission/release varies depending on the sources of mercury release/emission. Mining workers (artisanal and large scale), general and medical waste collectors, community living close or downstream of waste dumping sites, painters are among the most vulnerable to mercury exposure. The awareness on the health and environmental hazardous of mercury exposure could cause is little understood by most of the vulnerable groups of the society. To minimize the exposure risk of mercury emission/release it is paramount importance to undertake rigorous awareness raising activities to promote their understanding about the sound management of mercury waste and other general waste as well application of good environmental practice. To this end, the development of a strategy for workers and public awareness raising would be necessary. Coordination and cooperation among the relevant of relevant government is highly needed.

## 5.2 National Strategy for Raising-Awareness among Targeted Groups

### 5.2.1 National Goals and Objectives

- Goal 1: Enhance awareness on vulnerable group about the risks of mercury
- Goal 2: Phase out the use of mercury on ASGM activities
- Goal 3: Managing and reducing the risks to human health and the environment posed by mercury and mercury-containing waste
- Goal 4: Reduce mercury releases from industries
- Goal 5: Promote the research and monitoring on mercury activities

### 5.2.2 Strategy for Vulnerable Groups

In Eritrea, most vulnerable groups are, among others, children, women and workers as described in detail below.

#### A. Children

Although, ASGM activities are rudimentary and rarely practiced in the country, children take part in the process usually assisting their families. Children fetch water for washing which can be used for washing the ore and tend to stay close to their parents who do the amalgamation and smelting of the amalgam. Owing to the smaller body weight compared to their surface of exposure to release as well as low level of immunity, children are at high risk. In addition to the serious health risk indicated, school drop-out is another challenge. Children living in close proximity to the sites where waste open fire burning and general waste disposal is practiced are also vulnerable to mercury emissions and releases.

#### B. Women

The ASGM overview revealed that, in the rare and informal ASGM activities, women are mostly involved in the gold panning process and seldom in the excavating and digging of ore, that such actions entail physical efforts and hardship and deemed by most of the inhabitant as men's task. In addition to the gold panning activities, the hazardous mercury amalgamation and amalgam burning is done by women. This became more damaging on pregnant and breastfeeding women. Developing a strategy on awareness raising activities targeting these groups would have paramount importance.

#### C. Workers

The mercury inventory has confirmed the presence of releases of mercury from different industrial sources, ASGM activities, formal and informal waste disposal sites, including incineration and open burning, etc. The people who work and spend most of their time at closer to the sites and who are engaged in such activities are highly exposed to mercury risk. The assessment also revealed the workers understanding about the risk of mercury exposure and the means of reducing exposure is limited. Awareness raising strategy specifically targeting these groups is essential.

## 5.3 Implementing the Strategy/Action Plan for Awareness Raising among the Priority Groups

In the validation and inception workshop, they have been provided some limited awareness raising activities on the issues surrounding mercury, in particular for miners and stakeholders, but also urgently needed in the form of training and seminars on the alternatives to the use of mercury and mercury-products, proper management, storage, transport and disposal mercury containing products and wastes. Table 5.1 puts in place the proposed action plan for awareness raising among targeted groups.



## 5.4 National Awareness-Raising Campaign for Key Sectors

Based on article 18 on public information, awareness and education, Eritrea should develop a regime of how to educate the public and raise its awareness on the long-term mercury and mercury compounds risk to health and environment. This effort should consider and depend on the level of capacity of the country to develop a water-tight campaign. The campaign should be in any case a dynamic one to reach out all vulnerable groups, key sectors and actors notably.

The department of Environment by engaging itself with the following stakeholders and actors can be helpful in disseminating the mercury awareness raising information to all the following key sectors of the society:

All Ministries, especially the Ministries of Health, Local Government, Defence, National Development, Public Works, Agriculture, Marine Resources, Custom officers Transport and Communication, Labor and Social Wafer Information etc...;

- National Associations (workers, youth and women) and professional associations;
- Law enforcement organs (Police, Immigration and Customs Office among others);

- Health service providers (hospitals, health centres and stations);
- Industries, especially construction companies, paint industry, important & export companies;
- Urban municipalities and rural communities;
- Religious centres, kindergartens, Schools, Training Institutes and Colleges;
- Cooperation with Actors, VIPs and others.

By conducting and organising of various workshops and the activities listed in 5.1, the aforementioned stakeholders would assume the role of multiplayers for awareness raising campaigns. Such campaigns should be undertaken in a way that they are not time bounded. This means that time should be observed as an important factor. “The longer the better” should be the guiding principle for conducting the campaign.

## 5.5 Articles of the Minamata Convention Relevant for Eritrea in Terms of Awareness-Raising

Articles of the Convention that may have relevance to awareness raising and understanding of workers and the public are shown in Table 5.2.

Table 5.1: Proposed action plan for the awareness raising campaign

Item	Activities program	Time-frame	Responsible agencies	Anticipated budget USD
1	Organize larger public awareness raising campaign on the human health and environmental effects of mercury and mercury compounds by seminars and through the media.	2020-2021	DoE, MoI	40,000
2	undertake training on mercury management for vulnerable groups (e.g. waste handlers, dentists, schools, power plants and cement production)	2020-2023	DoE, Municipality, MoH,	30,000
3	Organize and conduct trainings on occupational health and safety measures for miners, ore processors, waste collectors, administrators	2020-2021	DoE, MoE, MoH, MoEM	15,000
4	Conduct training for gold miners to make them fully aware of human and environmental risks arising from mercury use and its risks and offering of alternative way of living	2020-2021	DoE, MoEM Local government	15,000
5	undertake training on mercury management for vulnerable groups (e.g. waste handlers, dentists, schools, power plants and cement production)	2020-2022	DoE, MoEM Local government	25,000
6	Organize and Promote school children to be focused on their education instead of participating in mining activities.	2020-2023	DoE, MoE and Local government	30,000
7	Promoting mercury research in institutes of higher education	2020-2021	DoE, MoE	10,000
8	Share the results and outcomes of assessments and studies pertaining to mercury with stakeholders and wider sphere through the creation of a repository for all relevant studies.	2020-2023	DoE	10,000
<b>Total</b>				<b>175,000</b>

Table 5.2: Articles of the Minamata Convention relevant for Eritrea

Articles	Relevance
Article 11 Mercury wastes	Applying Basel convention, proper handling of waste, segregation starting from family environs, no transport across international boundaries, international cooperation, etc
Article 12 Contaminated sites	Development of appropriate strategy. protection, management, rehabilitation, waste recycling and reduce risks.
Article 13 Financial resources and mechanism	National and international financial cooperation and partnership, in accordance with national policies, priorities, plans of Eritrea.
Article 14 Capacity-building, technical assistance and technology transfer	Need of technical cooperation and technology transfer, sustainable human resources development, offering alternative technologies.
Article 16 - Health aspects	Need of international partnerships and cooperation in conducting in-depth health related surveys and investigation, provision of appropriate solutions among others
Article 17 Information exchange	National and international exchange of information and experience
Article 18 Public information, awareness and education	Conducting of strengthened public awareness raising campaigns, especially on vulnerable groups
Article 19 Research, development and monitoring	Relentlessly carrying out professional research through survey field works and monitoring; supplying of valuable information to policy makers.
Article 20 Implementation plans	Adhere to strictly implement plans and their time schedule, as much as possible; seeking international support and partnerships in implementation.

# 6. PRIORITIES FOR ACTION, IMPLEMENTATION PLANS AND MAINSTREAMING OF THE PRIORITIES

## 6.1 Introduction

On the basis of the results of the various evaluations presented in the previous chapters, the national priorities have been identified and respective implementation plans proposed, as follows. The ordering does not represent a ranking of priorities.

1. Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention for the management of mercury at national level;
2. The phasing-down and phasing-out of the import of mercury-added products;
3. Putting in place an environmentally sound management system for waste management, including mercury-containing waste; aligning it to the national waste management regulation
4. Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining;
5. Safeguarding suspected mercury contaminated sites/ areas.

The Sustainable Development Goals (SDGs)<sup>126</sup> relevant for these intervention plans are the following:

- Goal 3: Ensure healthy lives and promote well-being for all at all ages
- Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
- Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- Goal 12: Ensure sustainable consumption and production patterns
- Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

The response plans proposed in this chapter can be integrated into the following existing national action plans at the national level:

- Indicative Development Plan (for Developing a Dynamic Economy and Better Quality of Life for all Citizens), 2009 – 2013: It is a five-years indicative plan which emanates with targeting at developing and reconstructing the economy of the country. It is based on Eritrea's aspiration to grow into a developed and democratic nation. The vision of the country is to register all rounded progress among others economically, socially, politically and culturally.
- The Second Health Sector Strategic Development Plan, 2017-2021: One of the main goals of Eritrea is to develop a strategy on the health sector that guarantees the health of its people and environment. The health sector faces many challenges of communicable and non-communicable diseases as well as the new re-emerging health threats. The government of Eritrea is determined to overcome the health challenges that its people are facing.
- The National Gender Action Plan, 2015-2019: The National Gender Action Plan is an action plan based on the national gender policy. Eritrea aims to stimulate gender equality between women and men in the country that is based on the principles of promoting development, prosperity and peace within Eritrea. The action plan obeys several national and international regulations on the promotion of gender equality among others are the Convention on the Elimination of All Forms of Discrimination against women.
- National Implementation Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs), 2019-2025: This action plan is mainly focused at ensuring sound management of POPs chemical and their wastes. Beyond addressing that national interest, the documents comply with fundamental principles of the Stockholm Convention which aims to protect human health and the environment from adverse effects of persistent organic pollutants. The main objective of the national implementation plan is to eliminate the use of banned POPs and continues using under controlled for those restricted POPs. To ensure several action plans are proposed among which include the Promotion of Public awareness, development of sound management tool, regulations, guidelines, and technical and human capacity build-ings.
- The Strategic Partnership Cooperation Framework (SPCF) between the Government of the State of Eritrea and the United Nations, 2017-2021: This SPCF focuses on development cooperation agreement between the Government of the State of Eritrea and the United Nations. The SPCF aims at enhancing the Eritrean development plan in order to build prosperous,

peaceful and just country that emanates from self-reliance principles of the Government of Eritrea. The SPCF is based on four strategic pillars which include basic social services, environmentally sustainable, resilience and disaster risk management, public sector capacity development and inclusive growth, food security and sustainable livelihoods.

## 6.2 Summary of Estimated Budget

The indicative budget proposed in this chapter will be subject to further economic assessment before the implementation of such activities and the summary of the indicative budget for the action plans is given in Table 6.1.

### 6.3 PRIORITY AREA AND INTERVENTION PLAN 1: Strengthening of the Legal and Institutional Capacity for the Integration of the Provisions of the Minamata Convention at National Level

Eritrea does not have a specific law pertaining to the proper use and management of mercury. For this reason, the legal and institutional capacity building assessments were carried out. On the basis of such assessments, it is of a paramount necessity to draft and formulate a law specific to mercury in accordance with the provisions of the Minamata Convention. The objectives and the proposed activities, timeline along with the relevant stakeholders and estimated budget are presented below (Table 6.2).

- Objective

The objective of this intervention plan is to update the legal and institutional frameworks so that they are adapted to effectively implement the provisions of the Minamata Convention pertinent to Eritrea. To this end, the following specific objectives should be taken into account:

(i) The creation of a committee of experts with the required skills and knowledge;

(ii) The establishment of coordination mechanisms, including consultation with relevant stakeholders (probably those involved in the MIA and ASGM NAP projects and any other relevant projects identified);

(iii) Review and update the content of the legal instruments relevant to the Convention identified during the legal assessment;

(iv) The creation of binding instruments for those aspects of the Convention not covered by existing instruments;

(v) Adapting the responsibilities of national institutions;

(vi) The establishment of a monitoring/control system to assess the implementation of and compliance with established instruments.

The measurable indicators of the legal and institutional capacity building of the intervention plan are:

- Composition of the committee's team of Experts established;
- Number of Meetings held by the Team of Experts;
- Number of existing legislation and proclamation reviewed additional provisions made;
- The number of capacity building events conducted;
- Number and type of Standards for mercury added products set;
- Monitoring/inspection activities conducted by the team of experts;
- Guidance given for the management of mercury added products;
- Number of beneficiary institution from capacity building/number of enforcement of officers trained.

Table 6.1: Summary of the Indicative budget for the action plan

Intervention Plan	Expenses (in USD)	Source of funding	Government Contribution (In kind) 10%
Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level	395,000	GEF, Minamata Secretariat (Specific International Program), other relevant funding agencies/institutions/Programs	Office facilities and logistical support for project staff
Phasing-down import of Mercury-added Products	945,000	GEF, Minamata Secretariat (Specific International Program), other relevant funding agencies/institutions/Programs, private companies	Office facilities and logistical support for project staff
Putting in place an environmentally sound management system for waste management, including mercury-containing waste	1,740,000	GEF, Minamata Secretariat (Specific International Program), other relevant funding agencies/institutions/Programs, private companies	Office facilities and logistical support for project staff
Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining	875,000	GEF, Minamata Secretariat (Specific International Program), other relevant funding agencies/institutions/Programs, private companies	Office facilities and logistical support for project staff
Safeguarding suspected mercury contaminated sites/areas	745,000	GEF, Minamata Secretariat (Specific International Program), other relevant funding agencies/institutions/Programs, private companies	Office facilities and logistical support for project staff
<b>Total</b>			<b>4,700,000.00</b>



Table 6.2: Intervention Plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level

Intervention Plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level				
Relevant SDGs: # 3, # 8, # 9, # 12, # 14, # 15 et # 16				
Relevant Articles of the Minamata Convention: Articles that have provisions identified as relevant during the national inventory and legal and institutional evaluations are relevant for this implementation plan (Namely Articles 3, 4 (Mercury-added products), 5, 7 (Artisanal and Small-scale Gold Mining), 8 (Emissions), 9 (Releases), 10 (Environmentally sound interim storage of mercury, other than waste mercury), 11 (Mercury Waste), 12 (Suspected contaminated sites), 16 (Health aspects), 17 (Information exchange), 18 (Public information, awareness and education), 19 (Research, development and monitoring))				
Relevant existing National Action Plans:				
<ul style="list-style-type: none"> <li>Measures to strengthen the national institutional capacity and the legal framework for POPs management (NIP)</li> <li>Implement efficient controlling procedures of illegal entry of POPs (NIP)</li> <li>Review and update of the existing legislative mechanisms of environmental safety related to POPs (NIP)</li> <li>Prepare and validate new legislative and regulatory texts to address the problem of entry and management new POPs (NIP)</li> <li>Develop standard mechanisms to strengthen the environmental management programs (NIP)</li> <li>Reinforce the existing protocols used by the customs office to control the import of pesticides and other (NIP)</li> <li>Implement efficient controlling procedures of illegal entry of POPs (NIP)</li> <li>Create and strengthen gender mainstreaming capacity building Programs for public sectors (National Gender Action Plan of Eritrea)</li> <li>Review and update health sector legislation (Health Sector Strategic Development)</li> <li>Develop a comprehensive national health act (Health Sector Strategic Development Plan)</li> <li>Institutional capacity development (National Indicative Development Plan)</li> <li>Promulgation of appropriate legislation (National Indicative Development Plan)</li> <li>Public sector capacity development (SPCF)</li> </ul>				
Key institutions: Ministry of Justice (MoJ), Ministry of Land, Water and Environment (MoLWE)				
Other relevant stakeholders and partners: Ministry of Energy and Mines (MoEM), Ministry Trade and Industry (Eritrean Standard Institute, and any other relevant ministry, Ministry of Finance (Customs' office)				
Period: 2021-2023		Period: 2021-2023		
Total Budget: 395,000				
Potential risks/limitations that may slow the implementation of the Action Plan:				
<ul style="list-style-type: none"> <li>Limited financial resources</li> <li>Limited expertise with knowledge and skill, related developing legal instruments and capacity building</li> <li>Limited technical and human capacity</li> <li>Low level awareness</li> <li>Limited coordination among key stakeholders</li> </ul>				
Proposed activities (or group of activities)	Description	Proposed activities (or group of activities)	Description	Proposed activities (or group of activities)
Preliminary/general activities and actions to put in place				
Establish a team of experts with experience in legal texts and institutional activities	The team of experts should be composed of experts from different legal fields and should have the necessary experience to draft national legal instruments that include the requirements of the Conventions. The team formed should: (i) have sufficient experience in the preparation of legal instruments, (ii) be aware of the various international conventions that Eritrea has signed and ratified	Establish a team of experts with experience in legal texts and institutional activities	The team of experts should be composed of experts from different legal fields and should have the necessary experience to draft national legal instruments that include the requirements of the Conventions. The team formed should: (i) have sufficient experience in the preparation of legal instruments, (ii) be aware of the various international conventions that Eritrea has signed and ratified	Establish a team of experts with experience in legal texts and institutional activities
Organize meetings and/or discussion workshops to meet needs to meet the requirements of the Convention, identify tools to be updated or created, allocate tasks and responsibilities and establish an appropriate work plan	It is necessary to identify more specifically the points to be improved in the legal framework as well as in institutional capacities. The experts will need to use the findings of the evaluation of legal and institutional frameworks as a basis for reorganizing and updating legislation and building institutional capacity.	Organize meetings and/or discussion workshops to meet needs to meet the requirements of the Convention, identify tools to be updated or created, allocate tasks and responsibilities and establish an appropriate work plan	It is necessary to identify more specifically the points to be improved in the legal framework as well as in institutional capacities. The experts will need to use the findings of the evaluation of legal and institutional frameworks as a basis for reorganizing and updating legislation and building institutional capacity.	Organize meetings and/or discussion workshops to meet needs to meet the requirements of the Convention, identify tools to be updated or created, allocate tasks and responsibilities and establish an appropriate work plan
Conduct capacity building and information trainings of each team according to the distribution of responsibilities. Details regarding each aspects of the Convention with regards to the national current frameworks should be given in order to emphasize the needed inputs.	It is important that team members be informed about the issues and objectives of this intervention plan. Responsibilities should be clearly distributed according to the skills of each member.	Conduct capacity building and information trainings of each team according to the distribution of responsibilities. Details regarding each aspects of the Convention with regards to the national current frameworks should be given in order to emphasize the needed inputs.	It is important that team members be informed about the issues and objectives of this intervention plan. Responsibilities should be clearly distributed according to the skills of each member.	Conduct capacity building and information trainings of each team according to the distribution of responsibilities. Details regarding each aspects of the Convention with regards to the national current frameworks should be given in order to emphasize the needed inputs.
Identify precisely the provisions of the national framework that can be amended but also the missing aspects that must be fully developed and integrated to meet the requirements of the Convention	The evaluations carried out under this MIA already provide a basis for precisely identifying the updates to be made and the procedures to be followed to validate the amendments.	Identify precisely the provisions of the national framework that can be amended but also the missing aspects that must be fully developed and integrated to meet the requirements of the Convention	The evaluations carried out under this MIA already provide a basis for precisely identifying the updates to be made and the procedures to be followed to validate the amendments.	Identify precisely the provisions of the national framework that can be amended but also the missing aspects that must be fully developed and integrated to meet the requirements of the Convention
Strengthening of the Legal framework: It is necessary to adapt each relevant piece of legislation in relation to each article of the Convention identified as relevant to Eritrea				

Mercury containing products (including medical devices): Elaborate specific policy/legal instrument that governs the importation, administration and proper use of mercury or mercury added products to comply with Article 4 of the Minamata Convention	The legislation to be implemented should cover all mercury-containing products listed in Annex A, Part I and identified as present in Eritrea, mainly Paints with mercury preservatives, Medical blood pressure gauges (mercury sphygmomanometers), Batteries with mercury, Electrical switches and relays with mercury, Other laboratory and medical equipment with mercury and Thermometers.	Mercury containing products (including medical devices): Elaborate specific policy/legal instrument that governs the importation, administration and proper use of mercury or mercury added products to comply with Article 4 of the Minamata Convention	The legislation to be implemented should cover all mercury-containing products listed in Annex A, Part I and identified as present in Eritrea, mainly Paints with mercury preservatives, Medical blood pressure gauges (mercury sphygmomanometers), Batteries with mercury, Electrical switches and relays with mercury, Other laboratory and medical equipment with mercury and Thermometers.	Mercury containing products (including medical devices): Elaborate specific policy/legal instrument that governs the importation, administration and proper use of mercury or mercury added products to comply with Article 4 of the Minamata Convention
Dental Amalgams: Elaborate a legislation to address the phasing-down dental amalgam	The legislation to be developed should take into account the following elements (based on Part II of Annex A of the Minamata Convention): (i) dental caries prevention and health promotion; (ii) measures for minimizing the use of dental amalgam; (iii) Promote research and development of quality mercury-free materials for dental restoration (iv) Promote the use of cost-effective and clinically effective mercury-free for dental restoration; (v) Educate dental professionals and students on the alternatives; (vi) Update insurance policies and programs for enhancing and facilitating the use of alternatives; (vii) Best Environmental Practices in dental facilities.	Dental Amalgams: Elaborate a legislation to address the phasing-down dental amalgam	The legislation to be developed should take into account the following elements (based on Part II of Annex A of the Minamata Convention): (i) dental caries prevention and health promotion; (ii) measures for minimizing the use of dental amalgam; (iii) Promote research and development of quality mercury-free materials for dental restoration (iv) Promote the use of cost-effective and clinically effective mercury-free for dental restoration; (v) Educate dental professionals and students on the alternatives; (vi) Update insurance policies and programs for enhancing and facilitating the use of alternatives; (vii) Best Environmental Practices in dental facilities.	Dental Amalgams: Elaborate a legislation to address the phasing-down dental amalgam
Following the prohibition of import of mercury containing products, elaborate legally-binding measures to enhance the application of the law	Following the update of the legal framework, it will be necessary to take the following additional measures: (i) Update Customs legislation on import tax and mercury imported; (ii) Update national laws to provide for manufacturing, trade, supply, import or export of mercury and mercury-added products explicitly; (iii) Put in place measures for phasing-down the use of dental amalgam.	Following the prohibition of import of mercury containing products, elaborate legally binding measures to enhance the application of the law	Following the update of the legal framework, it will be necessary to take the following additional measures: (i) Update Customs legislation on import tax and mercury imported; (ii) Update national laws to provide for manufacturing, trade, supply, import or export of mercury and mercury-added products explicitly; (iii) Put in place measures for phasing-down the use of dental amalgam.	Following the prohibition of import of mercury containing products, elaborate legally-binding measures to enhance the application of the law
Develop a policy to promote the use of mercury-free alternatives identified and made available on the market	The measures to be put in place during this activity are intended to facilitate the import, production and/or export of alternatives to mercury-containing products currently on the market.	Develop a policy to promote the use of mercury-free alternatives identified and made available on the market	The measures to be put in place during this activity are intended to facilitate the import, production and/or export of alternatives to mercury-containing products currently on the market.	Develop a policy to promote the use of mercury-free alternatives identified and made available on the market
ASGM: update the existing policies on Artisanal Mining to include the provisions of Article 7 of the Minamata Convention	Existing laws on the gold panning sector, or at least on mining, must take into account the following aspects: (i) officially recognize ASGM; (ii) Develop appropriate measures for enhancing the reduction and, when feasible, elimination of the use of mercury and mercury compounds in ASGM; (iii) Addition of mercury (and its compounds) to the list of hazardous chemicals.	ASGM: update the existing policies on Artisanal Mining to include the provisions of Article 7 of the Minamata Convention	Existing laws on the gold panning sector, or at least on mining, must take into account the following aspects: (i) officially recognize ASGM; (ii) Develop appropriate measures for enhancing the reduction and, when feasible, elimination of the use of mercury and mercury compounds in ASGM; (iii) Addition of mercury (and its compounds) to the list of hazardous chemicals.	ASGM: update the existing policies on Artisanal Mining to include the provisions of Article 7 of the Minamata Convention
Sound Management of Waste: develop a legal framework that integrates the domestication of the Basel and the Minamata Convention (Article 11) in terms of sound management of waste	The evaluation of the national legal framework concluded that there is a first project on the management of hazardous waste. This activity will not only complete the project but will also strengthen it by including provisions for waste management in general and the establishment of an appropriate system.	Sound Management of Waste: develop a legal framework that integrates the domestication of the Basel and the Minamata Convention (Article 11) in terms of sound management of waste	The evaluation of the national legal framework concluded that there is a first project on the management of hazardous waste. This activity will not only complete the project but will also strengthen it by including provisions for waste management in general and the establishment of an appropriate system.	Sound Management of Waste: develop a legal framework that integrates the domestication of the Basel and the Minamata Convention (Article 11) in terms of sound management of waste
Emissions and releases: put in place national policies for enhancing the development of standards on air, water and soil quality as well as the development of adequate guidelines to reduce emissions and releases to the environment	The legislation to be put in place will have to take into account emissions from point sources such as industrial gold mining, copper and zinc mining and cement clinker production. Releases to water and land in general should also be considered, in particular by setting standard and limit values.	Emissions and releases: put in place national policies for enhancing the development of standards on air, water and soil quality as well as the development of adequate guidelines to reduce emissions and releases to the environment	The legislation to be put in place will have to take into account emissions from point sources such as industrial gold mining, copper and zinc mining and cement clinker production. Releases to water and land in general should also be considered, in particular by setting standard and limit values.	Emissions and releases: put in place national policies for enhancing the development of standards on air, water and soil quality as well as the development of adequate guidelines to reduce emissions and releases to the environment

In developing the necessary regulations that include the requirements of the Minamata Convention, ensure that enhancing regular data gathering and updating as well as access to information (on the effects of hazardous chemicals for example) are included.	For each subject addressed by updating the legislative framework, it will be necessary to encourage the constant collection and updating of data so that the legislative framework is always adapted accordingly.	In developing the necessary regulations that include the requirements of the Minamata Convention, ensure that enhancing regular data gathering and updating as well as access to information (on the effects of hazardous chemicals for example) are included.	For each subject addressed by updating the legislative framework, it will be necessary to encourage the constant collection and updating of data so that the legislative framework is always adapted accordingly.	In developing the necessary regulations that include the requirements of the Minamata Convention, ensure that enhancing regular data gathering and updating as well as access to information (on the effects of hazardous chemicals for example) are included.
<b>Strengthening of the Institutional framework: The institutional evaluation revealed the need for institutions to strengthen their capacities</b>				
Strengthen the personal and technical capacities of institutions	Institutional staff should be trained on the Minamata Convention. The Directorates of the Ministries concerned should be strengthened according to the provisions of the Convention to be implemented	Strengthen the personal and technical capacities of institutions	Institutional staff should be trained on the Minamata Convention. The Directorates of the Ministries concerned should be strengthened according to the provisions of the Convention to be implemented	Strengthen the personal and technical capacities of institutions
Strengthening the scientific capacity of institutions	Train and develop qualified professional and scientific expertise in environmental protection and management, in particular mercury management and use. For example, lab technicians;	Strengthening the scientific capacity of institutions	Train and develop qualified professional and scientific expertise in environmental protection and management, in particular mercury management and use. For example, lab technicians;	Strengthening the scientific capacity of institutions
Establish a data directory for each category of sources identified as present in Eritrea	This database will make it possible to collect and regularly update information on each category in order to enable the institutions (MoLWE, MoEM, MoH, MoTI) to take appropriate action.	Establish a data directory for each category of sources identified as present in Eritrea	This database will make it possible to collect and regularly update information on each category in order to enable the institutions (MoLWE, MoEM, MoH, MoTI) to take appropriate action.	Establish a data directory for each category of sources identified as present in Eritrea
<b>Overall Monitoring and control system</b>				
Establish sustainable control/monitoring systems (with competent personnel accordingly trained) to ensure the respect and application of the updated legal instruments on mercury and mercury compounds fluxes, use, emission, release, and disposal to ensure compliance with the Convention	Once the required capacities have been built and actions implemented, it will be necessary to monitor and evaluate progress to ensure the effectiveness of the measures or even to rectify a situation if necessary.	Establish sustainable control/monitoring systems (with competent personnel accordingly trained) to ensure the respect and application of the updated legal instruments on mercury and mercury compounds fluxes, use, emission, release, and disposal to ensure compliance with the Convention	Once the required capacities have been built and actions implemented, it will be necessary to monitor and evaluate progress to ensure the effectiveness of the measures or even to rectify a situation if necessary.	Establish sustainable control/monitoring systems (with competent personnel accordingly trained) to ensure the respect and application of the updated legal instruments on mercury and mercury compounds fluxes, use, emission, release, and disposal to ensure compliance with the Convention
<b>Total Budget</b>				<b>805,000</b>
NB:10% of the budget comes from the Government of Eritrea in kind.				

## 6.4 PRIORITY AREA AND INTERVENTION PLAN 2: The Phasing-Down and Phasing out of the Mercury-Added Products

Eritrea is neither a producer nor an exporter of mercury and mercury added products. However, the country does import mercury added products. That being said, Eritrea has now taken the initial steps to undertake a considerable set of measures to curbe the import of these products by signalling its readiness to be a party to the Minamata Convention, looking into legal instruments, through awareness raising programmes, seeking to replace the aforementioned products in phases by mercury free products. The objectives and the proposed activities, time framework along with the relevant stakeholders and estimated budget are presented below (Table 6.3).

### • Objective

The objective of this national plan is directly aligned with the Convention's obligations to phase-out the production, import and use of mercury-containing products in the country by 2025 and also to phase-down the use of dental amalgam. To do this, it is necessary to achieve, among other things, the following results:

(i) Use national tools that integrate this provision into the national legal framework (to be done in Implementation Plan 1) to identify relevant activities to be carried out;

(ii) The organization of workshops / activities to inform and sensitize the population on the danger posed by these products to health and the environment in order to encourage changes in habits and prepare for the introduction of alternatives on the market;

(iii) The identification of alternatives to each type of mercury-containing product and a thorough economic analysis of the feasibility of introducing these alternatives into the national territory;

(iv) The establishment of a monitoring and control system to prevent parallel (illegal) trade in mercury-containing products after the ban and to assess changes resulting from the activities put in place;

(v) Reduce the demand for dental restoration;

(vi) Promote mercury-free dental equipment;

(vii) Develop a strategy to improve access to dental care;

(viii) Establish a health and dental insurance system that supports mercury-free products;

(ix) Promote the use of existing Best Available Techniques (BAT) and Best Environmental Practices (BEP) in dental care;

(x) Reduce, with a view to its gradual elimination, the use of dental amalgam;

(xi) Organize awareness-raising activities that in-

volve the College health Sciences (Department of Dental Surgeon) and civil society on dental health.

Measurable indicators for the phasing-out and phasing-down of the import of mercury added products conducted, are the following but not limited to:

- The composition of Product Advisory Committee;
- The Stakeholders identified to take part in the implementation of the Action Plan;
- The number of inception meetings of the PAC organized and conducted;
- Coordination mechanisms set and the relevant actors/institutions identified and represented;
- Strategy to prohibit the importation of mercury containing products developed;
- The Information identified/collected and the national data base system proposed;

- information identified and collected to complete the inventory carried put within the framework of the MIA identified and collected;
- meeting/programs/activities organized and conducted to raise the awareness of the health care professionals about the viable/available mercury-free alternatives products;
- workshops/campaigns organized and carried out to disseminate information on appropriate measures to prevent cavities and activities to promote health;
- List of economically viable mercury free alternative products identified to be introduced in the market;
- Monitoring system established to prevent “informal entries of mercury containing products;
- Amount and type of Mercury containing products collected and the methodology developed;
- The study team established;

Table 6.3: Intervention Plan 2: Phasing-down and phasing-out of the production, export and/or import of Mercury-added Products

Intervention Plan 2: Phasing-out and phasing down of the import of Mercury-added Products				
Relevant SDGs: # 3, # 9, # 12, # 14, # 15 et # 16				
Relevant Articles of the Minamata Convention: Article 4 (Along with Annex A, Part I) but also Articles 8, 9, 12, 16, 17 and 18				
Article 4: Mercury-added products (and Annexe A, Part I):				
<ul style="list-style-type: none"> <li>• Prohibit the manufacture, import and export of mercury-added products.</li> <li>• Part I: Phased-out mercury-added products by the end of 2020 (Batteries, Switches and relays, Compact fluorescent lamps (CFLs), High pressure mercury vapour lamps (HP-MV)), 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.</li> </ul>				
Relevant existing National Action Plans:				
<ul style="list-style-type: none"> <li>• Strengthen the coordination group among the main stakeholders (NIP)</li> <li>• Develop standards and indicators to assess the socioeconomic impacts (NIP)</li> <li>• Establish guidelines for new POPs wastes management and include the new POPs in the missions/ mandates of concerned institutions (NIP)</li> <li>• Conduct annual national inventory on the status of obsolete pesticides (POPs if found) in different pesticide stores found in the country (NIP)</li> <li>• Develop a data system on the past and exiting import, use, stockpiles and wastes of POPs pesticides (NIP)</li> <li>• Conduct a national assessment on the status of the current public awareness related to the emissions, health and environmental effects caused by the different categories of POPs (NIP)</li> <li>• Conduct training activities by preparing informative material or use ready material for information dissemination at different levels (NIP)</li> <li>• Increase information and the level of awareness among the general public and authorities in order to increase the representation of women in power and decision-making (National Gender Action Plan of Eritrea)</li> <li>• Increased public awareness, especially on family laws and legislation ((National Gender Action Plan of Eritrea)</li> <li>• Initiate a web-based National Data Warehouse for HMIS, Review core set of indicators and develop a meta-data dictionary (Health Sector Strategic Development Plan)</li> <li>• Improve coordination, harmonisation and alignment of health resources from all sources (Health Sector Strategic Development Plan)</li> <li>• Training of Ministry, Zoba/Industry staff (National Indicative Development Plan)</li> <li>• Increase access to inclusive equitable and quality early learning and basic education (SPCF)</li> </ul>				
Key institutions: Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Trade and Industry, Department of Customs				
Other relevant stakeholders and partners: Ministry of Information (MoI), Ministry of Labour and Social Welfare (MoLSW), Ministry of Energy and Mines				
Period: 2021-2025		Level of Priority: High		
Total Budget: 945,000				
Potential risks/Barriers that may hinder the effective implementation of the Action Plan:				
<ul style="list-style-type: none"> <li>• Insufficiency of financial resources</li> <li>• Limited technical and human capacity</li> <li>• Low level awareness</li> <li>• Limited coordination among key stakeholders</li> </ul>				
Proposed activities (or group of activities)	Description	Relevant stakeholders	Timeline	Budget estimates (USD)
Preliminary/general activities and actions to put in place				
Set mechanisms of coordination and identify relevant actors (ministries, stakeholders) to be part of a “Products Advisory Committee” (PAC)	PAC members should be selected based on their expertise and the added value they can bring to the process of reducing the use of mercury-containing products.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labour and Social Welfare (MoLSW), Eritrean Customs Ministry of Trade and Industry (Eritrean Standards Institute	2024	15,000



Organize PAC inception meeting(s) for: (i) identifying and discussing best strategies to address existing issues, (ii) identifying the needs, (iii) classifying the priorities, (iv) defining the objectives, and (v) setting timing and project milestones. Financial and technical aspects should also be considered	The meetings will provide PAC members with an overview of the current national situation regarding mercury-containing products with respect to the provisions of the Minamata Convention. This will help to set priorities and propose the necessary contributions and measures to comply with the Convention. During these meetings, the results of the national mercury inventory will be used as a basis and additional missing information will be identified.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2024	20,000
Improve the national database on the fluxes of mercury-containing products in the country but also on mercury-containing products already present in the country. A detailed inventory as well as comprehensive classification of the products should be elaborated	If possible, it would be useful to update the mercury inventory by quantifying the actual imports of mercury-containing products, but also the quantities of mercury present in the country (retailer stocks and others) in order to have a clear overview of the products to be replaced when seeking alternatives.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2025	100,000
Based on the law banning the import of mercury-containing products and/or mercury compounds that will have been put in place during response plan 1, develop and implement a strategy to prohibit the entry of mercury-containing products into the country	This activity aims at developing a clear strategy with different steps to guide the process of phasing out mercury-containing products listed in Annex A (Part I) that are present in Eritrea. Awareness-raising and dissemination of information on article 4 of the Convention as well as on the new law to be adopted and on the health risks of mercury should be included.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2025	20,000
Identify and collect the information necessary to complete the inventory carried out within the framework of the MIA	Information such as the number of national dentists (private and public) still using dental amalgams containing mercury, the quantities of dental amalgams installed per year or other relevant information would be required to assess the extent of the measures to be taken.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2023	30,000
Specific activities to raise-awareness and collect remaining mercury-containing products				
Medical instruments: Inform and raise awareness among the health-care sector professionals regarding the impacts of mercury-containing materials and on the advantages of mercury-free alternatives	Thermometers, manometers, medical tensiometers, laboratory chemicals and other medical equipment containing mercury have been reported to be present in the country. Approaching the health sector on the impacts of the use and inappropriate disposal of these products on health and the environment will be necessary to improve habit change and the adoption of alternatives.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2024	50,000
Set up awareness-raising and information exchange campaigns to exchange information with the population on the health risks of mercury-containing products (batteries, light sources as well as other products identified in the mercury inventory) and on the guidelines of the Minamata Convention	Similarly, to the awareness activities on mercury-containing medical devices, this activity aims to improve changes in habits towards mercury-free alternatives, but also to encourage the collection of products still containing mercury.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2025	40,000
Encourage the collection of mercury-containing products still present on the territory with a view to their environmentally friendly recovery or disposal	After phasing out, it will be necessary to collect the remaining products on the national territory for recovery and/or possible disposal. The collection of instruments and products used in the medical sector can be a first step. As mentioned previously, this activity will depend on the capacities of the country since it is not an obligation of the Convention.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), Eritrean Customs and any other relevant institutions, including dentists' associations	2025	100,000
Identifying economically viable alternatives to each mercury containing products				
Based on the results of the MIA report as well as the detailed inventory and classification conducted, identify alternatives to each mercury containing product	alternatives will be needed for medical devices, light sources, batteries and cosmetics containing mercury among others.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Eritrean Customs and any other relevant institutions, including dentists' associations	2025	30,000

Undertake an economic feasibility study to select the best option(s) for the country among the alternatives identified	This economic analysis could help identify the best options that will be financially viable for the country.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), dentists' associations	2025	20,000
Implement a strategy to raise awareness and inform the population about the benefits of these products in order to encourage a change in habits	The strategy will prioritize the different stages of awareness campaigns, the groups and regions to be prioritized and the communication tools adapted to each group and region.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), and any other relevant institutions, including dentists' associations	2024	10,000
Organize Information dissemination campaigns to promote the identified mercury-free alternatives, explaining their advantages for human health and the environment	This activity is necessary to prepare for the replacement of mercury-containing products. It can also help to avoid a decline in trade when alternatives are put on the market because civil society will be informed of the changes and their benefits.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), and any other relevant institutions, including dentists' associations	2025	50,000
Introduce the alternatives on the market	Gradually replace mercury-containing products on the market with cheap alternatives.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Eritrean Customs, Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), and any other relevant institutions, including dentists' associations	2024	50,000
Phasing-down dental amalgams				
Develop an effective strategy to guide the process of phasing out the use of mercury-containing dental amalgam	The strategy should include the necessary steps, from the choice of alternatives to their introduction into society and raising awareness among practitioners and civil society.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), dentists' associations	2025	50,000
Develop an appropriate strategy for the environmentally sound management of amalgam still available to dentists and their waste	A system for collecting the amalgam still present on the national territory should be proposed, as well as the best techniques for recycling/treating/disposing these products and their waste.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), dentists' associations	2024	50,000
Organize workshops/campaigns to disseminate information on appropriate measures to prevent cavities and activities to promote health	By promoting practical measures to be adopted on a daily basis, the objective is to prevent cavities and thus naturally reduce the need for dental restoration.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), Ministry of Information (MoI), Ministry of Labor and Social Welfare (MoLSW), and any other relevant institutions, including dentists' associations	2024	30,000
Identify different alternatives and undertake an economic analysis to choose economically viable options for the country	Alternatives already exist to replace the mercury-silver alloy used in current amalgams. By identifying the most practical and economically viable ones, this will support the arguments to convince professionals and civil society.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), dentists' associations	2024	50,000
Develop a strategy to facilitate access to dental care and establish health systems for the prevention of caries and, where appropriate, mercury-free alternatives in dental restoration	If health systems offered to civil society offer benefits in the choice of mercury-free solutions, this will encourage a gradual change in practice and thus reduce the use of mercury-containing options.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), dentists' associations	2024	30,000
Establish a system for the management of dental amalgam and its waste	On the basis of the strategy developed on this subject, set up the system to collect, treat, recycle and/or permanently dispose of dental amalgam and its waste.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH), dentists' associations	2025	150,000
Monitoring				
Develop a monitoring system to prevent "informal" entries of mercury containing products in the country, control the use of alternatives instead of mercury-containing products and measure progress over time	Once alternatives are available, awareness and information campaigns are conducted and the process of reducing imports and use of mercury-containing products has begun, it is essential to set up a monitoring system to monitor the proper functioning of the practices and rules put in place.	Ministry of Land, Water and Environment (MoLWE), Ministry of Health (MoH),	2024	50,000
TOTAL Budget				945,000
NB:10% of the budget comes from the Government of Eritrea in kind.				

## 6.5 PRIORITY AREA AND INTERVENTION PLAN 3: Putting in Place an Environmentally Sound Management System for Waste Management, Including Mercury-Containing Waste

The establishment of sound management systems for wastes is of the utmost importance to protect the environment from pollution. On the basis of the assessments undertaken regarding the management of wastes in general and to mercury-containing products in particular, segregation of wastes was not practical in the country. No landfills available for the wastes: open burning is the main practice. Most of the incineration apparatuses in the cities are not working properly. This will have a negative impact on the environment and human health. Thus, the need for a sound management system for wastes is vital. The objectives and the proposed activities, timeline along with the relevant stakeholders and estimated budget are presented below (Table 6.4).

- Objective

The objective of this action plan is to present the necessary steps for the establishment of a suitable structure for the environmentally sound management of waste, in particular waste containing mercury and mercury compounds. This includes the following achievements:

- (i) The creation of a committee of experts with the necessary skills for waste management;
- (ii) Updating the inventory of disposal sites and existing structures;

- (iii) Detailed analysis of the types of waste present;
- (iv) The development and implementation of detailed strategies and measures for the effective management of waste, including mercury-containing waste (in accordance with the enhanced legislation put in place under response plan 1);
- (v) Identification of appropriate techniques at each stage of the management process;
- (vi) Identification of nationally appropriate final disposal methods.

On implementing the intervention plan 3, the following measurable indicators will be practical:

- Composition of the Steering committee formed;
- Awareness/training materials developed for Committee members and stakeholders;
- Stakeholders selected for awareness/training;
- Duration of the training events;
- Waste sites identified to be part and parcel of the inventory;
- System proposed/developed for collection and segregation of waste;
- Environmentally sound waste management system proposed;
- Awareness-raising training programs carried out to professionals and civic society;
- Monitoring system Proposed;

Table 6.3: Intervention Plan 2: Phasing-down and phasing-out of the production, export and/or import of Mercury-added Products

Intervention Plan 3: Putting in place an environmentally sound management system for waste management, including mercury-containing waste
Relevant SDGs: # 3, # 9, # 12, # 14, # 15 et # 16
Relevant Articles of the Minamata Convention: mainly Article 11, but also Articles 12, 16, 17 and 18
<p>Article 11: Mercury waste</p> <ul style="list-style-type: none"> <li>• Each Party shall take appropriate measures so that mercury waste is: (i) Managed in an environmentally sound manner, taking into account the guidelines developed under the Basel Convention and in accordance with requirements of the Conference of the Parties to the Minamata Convention; (ii) Only recovered, recycled, reclaimed or directly re-used for use allowed to a Party under this Convention or for environmentally sound disposal pursuant to paragraph 3 (a);</li> <li>• 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 the Basel Convention.</li> </ul> <p>Article 12: Suspected contaminated sites</p> <ul style="list-style-type: none"> <li>• Each party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds.</li> </ul> <p>Article 16: Health Aspects</p> <ul style="list-style-type: none"> <li>• Parties encouraged to Promote the development and implementation of strategies and Programs to identify and protect populations at risks;</li> <li>• Develop and implement science-based educational and preventive Programs 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.</li> </ul> <p>Article 17: Information Exchange</p> <ul style="list-style-type: none"> <li>• Each Party shall facilitate the exchange of: (a) Scientific, technical, economic and legal information concerning mercury compounds, including toxicological, Eco-toxicological and safety information; (b) Information on the reduction or elimination of the production, use, trade, emissions and releases of mercury and mercury compounds; (c) Information on technically and economically viable alternatives to: (i) mercury-added products; (ii) manufacturing processes in which mercury or mercury compounds are used and (iii) activities and processes that emit or release mercury or mercury compounds; (d) Epidemiological information concerning health impacts associated with exposure to mercury and mercury compounds, in close cooperation with WHO and other relevant organizations, as appropriated.</li> </ul> <p>Article 18: Public information, awareness and education</p> <ul style="list-style-type: none"> <li>• Each Party to promote and facilitate: (i) 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; (ii) Education, training and public awareness related to the effects of exposure to mercury and mercury compounds; (iii) 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.</li> </ul>
<p>Relevant existing National Action Plans:</p> <ul style="list-style-type: none"> <li>• Promote environmentally sound management of medical wastes by building appropriate sites (NIP)</li> <li>• Conduct in-depth inventory and assessments of the suspected contaminated sites related to POP pesticides, PCBs and other chemicals (NIP)</li> <li>• Conduct a national assessment on the status of the current public awareness related to the emissions, health and environmental effects caused by the different categories of POPs (NIP)</li> <li>• Create coordination mechanism with stakeholders on the awareness about risks related to new POPs</li> <li>• Conduct training activities by preparing informative material or use ready material for information dissemination at different levels (NIP)</li> <li>• Creating public awareness on electronic waste and the hazards posed by unsafe disposal and open burning of solid wastes (NIP)</li> <li>• Increase access to and accessibility of education and training in remote places, amongst nomadic and semi-nomadic communities and displaced people, in particular for women and girls (National Gender Action Plan of Eritrea)</li> <li>• Develop HMIS / M&amp;E guidelines and a training plan for in-service training (Health Sector Strategic Development Plan)</li> <li>• Strengthening community resilience to disaster (SPCF)</li> </ul>

Key institutions: Ministry of Land, Water and Environment (MoLWE)				
Other relevant stakeholders and partners: Ministry of Labour and Social Welfare (MoLSW), Ministry of Local Government (MoLG)				
Period: 2021-2025		Level of Priority: Medium to high		
Total Budget: 1,740,000 USD				
Potential risks/Barriers that may hinder the effective implementation of the Action Plan:				
<ul style="list-style-type: none"> <li>• Insufficiency of financial resources</li> <li>• Limited technical and human capacity</li> <li>• Low level awareness</li> <li>• Limited coordination among key stakeholders</li> </ul>				
Proposed activities (or group of activities)	Description	Relevant stakeholders	Timeline	Budget estimates (USD)
Preliminary/general activities and actions to put in place				
Gather the concerned experts to form a steering committee for the intervention plan	The members of the committee should have the necessary skills and experience in areas such as waste management, chemicals management and pollution and/or similar areas.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2022	20,000
Raise awareness among relevant stakeholders and committee members on the issue of sound waste management	This awareness will highlight the health and environmental risks of poor waste management, in particular mercury-containing waste, and the need to change practices to bring them into line with the signed conventions (such as those of Basel and Minamata).	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2022	30,000
Hold inception workshops to define the framework and discuss different aspects of the implementation of the plan	These workshops will provide an opportunity to discuss aspects such as: (i) the existing legislative framework and amendments made (based on response plan 1), (ii) the needs to be met to meet the requirements of the Convention (based on the results of the MIA), (iii) the objectives of the plan, (iv) the financial aspects and (v) the distribution of responsibilities.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2022	20,000
Specific activities (as part of a strategy to put in place an appropriate system for managing waste in an environmentally friendly manner)				
Identify and develop an inventory of all waste sites on the national territory	Information on waste sites and informal landfills where open burning is carried out should be collected in cooperation with the relevant entities to complement the conclusions of the MIA report	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2023	30,000
Identify and compile an inventory of all sites where medical devices and other mercury-containing products are stored or disposed of	It is necessary to identify and inventory all medical institutions, meteorological institutions, civil aviation and other relevant structures that store and incinerate mercury-containing devices and products. The following elements may be considered: all types of mercury-containing thermometers and mercury-containing laboratory and medical equipment.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2024	20,000
Develop a classification of the different groups of waste encountered	To set up this classification, it would be necessary to isolate mercury-containing products, including medical devices, and to propose a specific classification for these mercury-containing products.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2024	10,000
Develop national guidelines on the sound management of waste, in particular mercury containing waste	These national guidelines should be developed to support practical waste management and should be developed in accordance with the legal and institutional frameworks developed in response plan 1 and available international provisions and guidance.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2025	30,000
Design an adequate system for the collection and storage of waste, including mercury-containing waste	When developing the system, it is important to consider: the separation of mercury-containing products from other general waste; and in medical facilities, civil aviation and other relevant institutions, mercury-containing devices and other products should be separated from other waste. In addition, the system should identify the different stages of waste management, from collection to disposal, including recovery, recycling, treatment and other necessary steps. Transport aspects should also be taken into account.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2025	50,000



Conduct training sessions for professionals and awareness-raising campaigns for civil society	Training of professionals in the waste management sector, including on safety measures to be adopted in the workplace, the different categories of waste implemented, the modified legal and institutional framework and the different stages of the sound management system implemented (or to be implemented) in the country	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2025	40,000
Separate the different types of waste				
Segregate mercury-containing products from municipal waste streams	Separate mercury-containing products from municipal waste streams that otherwise harm human health and the environment and produce mercury emissions and releases after disposal or incineration.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2023	300,000
Separate discarded medical devices containing mercury from clinical wastes	Separate discarded medical devices containing mercury from clinical waste, which is otherwise harmful to human health and the environment, and which produces mercury emissions and releases after disposal or incineration.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2023	250,000
Implement BAT/BEP for e-waste management practices that minimize or prevent emissions and releases of mercury (and any other chemicals)	Support the application of BAT/BEP to the management of electronic waste that minimizes or prevents mercury emissions and releases.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2024	200,000
Establish environmentally sound interim storage of mercury-containing waste prior to disposal, in accordance with the provisions of the Basel Convention	The disposal sites made available serve as a first step and will help to facilitate a first sorting step. Mercury-containing waste can be isolated during sorting.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2024	300,000
Carry out awareness-raising campaigns aimed at civil society, stakeholders and all professionals and encourage the use of any temporary storage sites that may have been established	These campaigns will be used to inform and raise public awareness of the problems associated with inappropriate waste management, including the disadvantages of not separating waste types (in particular mercury-containing waste) and risks to health and the environment. This can facilitate the change of habit, sorting and use of the storage sites made available.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2022-2025	100,000
Establish appropriate sites for the different stages of the waste management system and identify the best techniques for each stage	The steps and techniques for recovery, treatment (chemical or other with reduced risks to health and the environment), recycling and appropriate final disposal methods must be carried out at appropriate sites and with the necessary equipment. Safety equipment for professionals should also be made available.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2024	300,000
Monitoring				
Set up a monitoring system	After the waste management system, with all appropriate measures, is installed, it will be necessary to monitor and evaluate the proper functioning of the structures as well as compliance with existing legally binding frameworks. Such monitoring can also be useful in rectifying a situation or measure that is considered ineffective.	Ministry of Land, Water and Environment (MoLWE), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG)	2024	40,000
TOTAL Budget (USD)				1,740,000
NB:10% of the budget comes from the Government of Eritrea inkind.				

## 6.6 PRIORITY AREA AND INTERVENTION PLAN 4: Reducing the Emissions of Mercury and Mercury Compounds from Cement Clinker Production Facilities and Industrial Gold Mining

The emissions of mercury and mercury compounds from factories and industries pose a serious damage to the aquatic, terrestrial and air space of the environment. The Eritrean cement factories are located in Massawa. The two factories are very near to the sea. The emissions of hazardous chemicals including mercury and mercury compounds could have a negative impact on the surrounding marine environment. Mercury or mercury compounds are very stable substances stay in the fish that consequently endangers the public health. Hence, this problem should be addressed and alleviated. The objectives and the proposed activities, timeline along with the relevant stakeholders and estimated budget are presented below (Table 6.5).

- Objective

This action plan, therefore, aims to encourage the adoption of appropriate measures to control and limit emissions and discharges of mercury and mercury compounds into air, water and soil. This plan will allow, among other things:

- To form a group of competent experts to deal with pollution issues;
- To update/confirm the national inventory carried out within the framework of the MIA project, in particular through a review and update of the Level 2 inventory;
- To identify, also on the basis of the results of the inventory, the industries and especially the processes that cause emissions and discharges of mercury and mercury

compounds into the environment;

- Identify and make available appropriate safety measures for professionals in contact with chemicals at large;
- Identify and implement alternative processes (less polluting methods);
- Raise awareness, inform and educate professionals in different sectors about the impacts of mercury and mercury emissions and releases on health and the environment as well as on the Best Available Techniques (BAT) and Best Environmental Practices (BEP) available.

During the implementation of this Action Plan, the following measurable indicators are proposed to be used:

- Competent National Experts for the steering committee identified;
- A steering committee established;
- Continuous expert committee meetings organised;
- Industries and factories that are sources of mercury emissions identified;
- Proposed safety measures;
- Alternative steps or measures that limit emissions and discharges identified;
- Awareness and training sessions on BAT and BEP to the target sectors organised and conducted;
- Strategy developed;
- Plan to identify and assess sites contaminated by emissions and discharges developed;
- Monitoring and evaluation of activities undertaken.

Table 6.5: Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining

Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining
Relevant SDGs: # 3, # 9, # 12, # 14, # 15 et # 16
Relevant articles of the Minamata Convention: Mainly Article 9, but also Articles 8, 12 and 16.
Article 8: Issues <ul style="list-style-type: none"> <li>• Require Best Available Techniques/ Best Environmental Practices (BAT/BEP) or emission limit values (ELVs) from new sources (defined in Article 8.2(c)) listed in Annex D;</li> <li>• Require one or more measures identified in Article 8.5 to control/reduce mercury emissions from existing sources listed in Annex D, which must be in operation at the source within 10 years;</li> <li>• Require monitoring/reporting and develop an inventory of mercury emissions from sources listed in Appendix D.</li> </ul>
Article 9: Discharges to water and land <ul style="list-style-type: none"> <li>• Require reporting or otherwise obtain the information necessary to identify relevant sources of mercury/composites of mercury releases to land and water and maintain an inventory of releases from identified sources;</li> <li>• Take one or more of the measures specified in Article 9.5 to control/reduce releases to land and water from relevant sources of mercury and mercury compounds identified by a country.</li> </ul>
Article 12: Suspected contaminated sites <ul style="list-style-type: none"> <li>• Develop appropriate strategies to identify and assess mercury/mercury compounds of suspected contaminated sites;</li> <li>• If risk reduction activities are undertaken at suspected contaminated sites, they should be carried out in an environmentally sound manner, including, if necessary, a risk assessment.</li> </ul>
Article 16: Health Aspects <ul style="list-style-type: none"> <li>• Promote the development and implementation of strategies to identify and protect populations at risk, such as the dissemination of guides on fish consumption;</li> <li>• Promote educational and preventive programs on occupational exposure to mercury;</li> <li>• Promote prevention, treatment and health services for the populations concerned;</li> <li>• Strengthen the capacity of institutions and health professionals to address health risks related to mercury exposure.</li> </ul>

<p>Relevant existing National Action Plans:</p> <ul style="list-style-type: none"> <li>• Equipping the laboratories in the MoLWE and/or MoA with the appropriate instrumentation required for the analysis of POPs (NIP)</li> <li>• Establishing accredited laboratories at national level (NIP)</li> <li>• Improve the status of all the dump sites in the country (NIP)</li> <li>• Select appropriate sites and thus build standard landfills (NIP)</li> <li>• Assess the status of all medical waste incinerators, purchase additional ones and make them work efficiently (NIP)</li> <li>• Conduct a national assessment on the status of the current public awareness related to the emissions, health and environmental effects caused by the different categories of POPs (NIP)</li> <li>• Effectively monitoring and evaluation of the implementation of the gender mainstreaming strategy and conduct of research to determine outstanding gaps and Impact of the strategy (National Gender Action Plan of Eritrea)</li> <li>• Improve access to and utilization of quality, integrated health and nutrition services to safeguard healthy lives and promote well-being for all (SPCF)</li> <li>• Environmental sustainability, resilience and disaster risk management (SPCF)</li> </ul>				
Key institutions: Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Health (MoH)				
Other relevant stakeholders and partners: Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Justice (MoJ)				
Period: 2021-2024		Level of Priority: Medium to high (depending on the profile of each region)		
Total Budget: 875,000 USD				
<p>Potential risks/Barriers that may hinder the effective implementation of the Action Plan</p> <ul style="list-style-type: none"> <li>• Insufficient financial resources</li> <li>• Limited national Expertise</li> <li>• Inadequate participation from stakeholders</li> </ul>				
Proposed activities (or group of activities)	Description	Relevant stakeholders	Timeline	Budget estimates (USD)
Identify experts national in the relevant fields to form a steering committee for the activities	Experts with backgrounds and experience in environmental sciences, particularly in environmental pollution by heavy metals or chemistry (possibly hydrogeology and toxicology) will be able to contribute their expertise.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI)	2025	40,000
Organize meetings of the committee of experts	These meetings will establish the framework of the plan, identify objectives and priorities, list sectors to focus on (including the results of the national mercury inventory and the National Action Plan), allocate responsibilities, discuss the budget and work plan.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI)	2025	30,000
Organize information exchange workshops with stakeholders in the sectors concerned (e. g. primary metal production or cement production)	The exchange workshops are a way of approaching the various industrial sectors concerned, exposing the problem to them and requesting their collaboration to limit pollution. During these workshops, aspects such as the provisions of the Convention, the results of the MIA as well as Eritrea's needs to meet the requirements of the Convention will be discussed.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI)	2024	30,000
If necessary, update the national mercury inventory for each of the sources concerned (Level 2 inventory with the development of national defect factors)	The collaboration of the industries concerned will make it possible to update the data and have a more accurate overview of the emissions and discharges resulting from extraction. The Level 2 inventory in the toolbox can be used after the development of country-specific default factors.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM)	2024 – 2025	120,000
Conduct an assessment of the practices used in each sector	This assessment will make it possible to identify the different extraction and production methods used and, above all, to identify the stages likely to cause mercury emissions and discharges into the environment.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM)	2024 – 2025	100,000
Specific activities to limit pollution and protect professionals				
Update the internal policies of the entities concerned, in this case the framework laws laying down fundamental principles for the protection of the environment and agriculture, especially their provisions relating to dangerous products	The updating of these framework laws will make it possible to include specific provisions on the control and reduction of emissions and discharges into the atmosphere, water and land as well as on the issue of suspected contaminated sites.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Justice (MoJ)	2025	30,000

Develop a strategy to facilitate the reduction of mercury emissions and releases to the environment	On the basis of the guidelines in Articles 8 and 9 of the Convention, develop a strategy that includes, inter alia, preventing the diversion of mercury or mercury compounds for use in the extractive sector, initiatives for training, education, awareness-raising and capacity-building of target groups, seeking alternatives to the most polluting technologies and collaboration with relevant entities.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM)	2025	30,000
For each sector, identify and make available appropriate equipment	Safety equipment is designed to limit contamination by professionals in direct contact with chemicals.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM)	2025	60,000
Identify alternative steps or measures that limit emissions and discharges (including Best Available Techniques and Best Environmental Practices)	For each polluting stage, the less polluting alternative or reduction (or even elimination) measures will make it possible to limit emissions and discharges.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM)	2025	300,000
Organize awareness and training sessions for staff in the target sectors	These sessions will be useful to inform professionals about the risks of mercury emissions and discharges to health and the environment, but also to encourage the adoption of safety measures and alternatives available to limit pollution.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI)	2023 - 2025	20,000
Make available the necessary elements to encourage each sector to put in place internal policies to encourage the use of safety measures	Having internal regulations that govern the adoption of safety measures and alternatives in place helps to regulate the practices used in each sector.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Health (MoH)	2025	25,000
Activities relating to pollution already caused				
Develop and implement a plan to identify and assess sites contaminated by emissions and discharges	It is essential to be able to identify and analyse sites potentially polluted by emissions and discharges from mining activities in order, inter alia, to choose the best remediation methods	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Health (MoH)	2024 – 2025	10,000
Develop and implement a management plan for identified suspected contaminated sites	Sites that are already contaminated by emissions and discharges must be treated to limit the expansion of pollution and perhaps attribute these sites to certain activities deemed possible in these areas.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Health (MoH)	2024 – 2025	30,000
Monitoring and evaluation of activities and progress				
Put in place a monitoring system	Monitoring will make it possible to evaluate the progress made but above all to check that the measures put in place are being used correctly. Regular monitoring also makes it possible to check the effectiveness of the measures and to rectify the situation if the expected results are not achieved.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Health (MoH)	2025	50,000
TOTAL Budget (USD)				TOTAL Budget (USD)
NB:10% of the budget comes from the Government of Eritrea in kind				



## 6.7 PRIORITY AREA AND INTERVENTION PLAN 5: Safeguarding Suspected Mercury Contaminated Sites/ Areas

The use of mercury in gold extraction in ASGM has the potential to contaminate soil, water and air. The extraction or amalgamation of gold with mercury is generally carried out in and around riverbeds or farmlands. The miners conduct this activity without any prior knowledge of the need for proper personal protective equipment and awareness of the health effects of mercury to humans, animals and plants. What aggravates the contamination is, that mercury or mercury compounds are very stable substances and stay in areas near the mining sites for a very long time. Hence, this problem or risk should be addressed properly and avoided when possible. The objectives, the proposed activities and timeline, along with the relevant stakeholders and estimated budget are presented below (Table 6.6).

- Objective

The objective of this intervention plan is to identify and conduct extensive assessment on the suspected contaminated sites/ areas so as to control and safeguard to the extent possible mercury contaminated soils. The following specific objectives are supposed to be taken:

- To form a team from various field of specialisations to deal with the environmental pollution issues;
- To update and closely monitor the ASGM activities pertaining to the MIA project;
- To identify and carry out proper safety measures to protect the professionals involved with the study and investigation of the suspected contaminated sites from the hazardous chemicals;

- To identify and conduct in-depth assessment of soil, water and air of the suspected contaminated sites.
- To collect various sample analysis from the suspected contaminated sites;
- To raise the awareness, inform and educate professionals as well as traditional miners about the health effect of mercury and mercury compounds.

Some of the following measurable indicators will be observed when the intervention plan 5 is properly carried out:

- A team of national experts from different disciplines identified/ formed;
- A steering committee established;
- Regular expert committee meeting organised;
- The stakeholders identified in the development and implementation of the Action plan on Mercury contaminated soils;
- Awareness and training sessions to the target sectors organised and conducted;
- Plan for the identification and assessment of contaminated developed;
- Extent of mercury pollution in soils, water and plant leaves identified;
- Management plan for identified suspected contaminated sites developed and implemented;
- Action plans for proper management of Mercury developed/proposed;
- Amount of mercury contaminated soil safeguarded;

Table 6.6: Intervention Plan 5: Safeguarding suspected mercury contaminated sites/areas

Intervention Plan 5: Safeguarding suspected mercury contaminated sites/areas
Relevant SDGs: # 3, # 9, # 12, # 14, # 15 et # 16
<p>Relevant articles of the Minamata Convention: Mainly Article 12, but also Articles 9, 16, 17 and 18</p> <p>Article 9: Discharges to water and land</p> <ul style="list-style-type: none"> <li>• Require reporting or otherwise obtain the information necessary to identify relevant sources of mercury/composites of mercury releases to land and water and maintain an inventory of releases from identified sources;</li> <li>• Take one or more of the measures specified in Article 9.5 to control/reduce releases to land and water from relevant sources of mercury and mercury compounds identified by a country.</li> </ul> <p>Article 12: Suspected contaminated sites</p> <ul style="list-style-type: none"> <li>• Develop appropriate strategies to identify and assess mercury/mercury compounds suspected contaminated sites;</li> <li>• If risk reduction activities are undertaken at suspected contaminated sites, they should be carried out in an environmentally sound manner, including, if necessary, a risk assessment.</li> </ul> <p>Article 16: Health Aspects</p> <ul style="list-style-type: none"> <li>• Promote the development and implementation of strategies to identify and protect populations at risk, such as the dissemination of guides on fish consumption;</li> <li>• Promote educational and preventive programs on occupational exposure to mercury;</li> <li>• Promote prevention, treatment and health services for the populations concerned;</li> <li>• Strengthen the capacity of institutions and health professionals to address health risks related to mercury exposure.</li> </ul> <p>Article 17: Information Exchange</p> <ul style="list-style-type: none"> <li>• Each Party shall facilitate the exchange of: (a) Scientific, technical, economic and legal information concerning mercury compounds, including toxicological, Eco-toxicological and safety information; (b) Information on the reduction or elimination of the production, use, trade, emissions and releases of mercury and mercury compounds; (c) Information on technically and economically viable alternatives to: (i) mercury-added products; (ii) manufacturing processes in which mercury or mercury compounds are used and (iii) activities and processes that emit or release mercury or mercury compounds; (d) Epidemiological information concerning health impacts associated with exposure to mercury and mercury compounds, in close cooperation with WHO and other relevant organizations, as appropriated.</li> </ul> <p>Article 18: Public information, awareness and education</p> <p>Each Party to promote and facilitate: (i) 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; (ii) Education, training and public awareness related to the effects of exposure to mercury and mercury compounds; (iii) 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.</p>

<p>Relevant existing National Action Plans:</p> <ul style="list-style-type: none"> <li>• Equipping the laboratories in the MoLWE and/or MoA with the appropriate instrumentation required for the analysis of POPs (NIP)</li> <li>• Establishing accredited laboratories at national level (NIP)</li> <li>• Improve the status of all the dump sites in the country (NIP)</li> <li>• Select appropriate sites and thus build standard landfills (NIP)</li> <li>• Assess the status of all medical waste incinerators, purchase additional ones and make them work efficiently (NIP)</li> <li>• Conduct a national assessment on the status of the current public awareness related to the emissions, health and environmental effects caused by the different categories of POPs (NIP)</li> <li>• Effectively monitoring and evaluation of the implementation of the gender mainstreaming strategy and conduct of research to determine outstanding gaps and impact of the strategy (National Gender Action Plan of Eritrea)</li> <li>• Environmental sustainability, resilience and disaster risk management (SPCF)</li> </ul>				
Key institutions: Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Health (MoH)				
Other relevant stakeholders and partners: Ministry of Labour and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Justice (MoJ)				
Period: 2021-2024		Level of Priority: Medium to high (depending on the profile of each region)		
Total Budget: 745,000 USD				
<p>Potential risks/Barriers that may hinder the effective implementation of the Action Plan:</p> <ul style="list-style-type: none"> <li>• Insufficient financial resources</li> <li>• Limited technical and human capacity</li> <li>• Low level awareness</li> <li>• Limited coordination among key stakeholders</li> </ul>				
Proposed activities (or group of activities)	Description	Relevant stakeholders	Timeline	Budget estimates (USD)
Preliminary/general activities and actions to be implemented				
Formation of a team of national experts from different relevant disciplines	Experts with backgrounds and experience in environmental sciences, soil sciences particularly in environmental pollution by heavy metals or chemistry (possibly hydrogeology and toxicology), will be able to contribute their expertise.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024	30,000
Regular experts' and steering committee meetings	These meetings establish the framework of the plan, identify objectives and priorities, list sectors to focus on previously conducted studies, identify and allocate responsibilities, discuss the budget and work plan.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024	20,000
Organize information exchange workshops with stakeholders in the sectors concerned	These workshops are necessary to provide information and steps to be taken for delimiting and fencing of the contaminated sites. Promote the safe and effective recovery and rehabilitation of the contaminated sites.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2023- 2024	30,000
Conduct an identification and assessment of the contaminated sites	This effort makes it possible to develop a data base on various national contaminated sites.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024 - 2025	90,000
Specific activities to limit pollution and protect professionals				
Develop a strategy to assess the contamination and prevention of the environment by mercury	On the basis of the guidelines in Articles 12 of the Convention, develop a strategy that will focus in preventing the use of mercury in ASGM activities.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM)	2024-2025	20,000

For each sector, identify and make available appropriate measures and safety equipment	These enable in protecting the people, wildlife and the environment from environmental incidents and emergencies and ensure that the effort can continue to carry out key safety, maintenance, support and administrative functions following an emergency or any serious incident.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024-2025	60,000
Identify alternative steps or measures that limit pollution (including Best Available Techniques and Best Environmental Practices)	For each polluting stage, the less polluting alternative or reduction (or even elimination) measures will make it possible to limit emissions and discharges.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024-2025	250,000
Organize awareness and training sessions for the public, decontamination personnel etc. in the target sectors	These activities develop an environmental rehabilitation and management plan for the contaminated site. It outlines procedures, organization, and instructions such that decontamination personnel understand and effectively implement environmental protection procedures on the work to be done.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024 - 2025	20,000
Activities relating to pollution already caused				
Develop and implement a management and monitoring plan for identified suspected contaminated sites	The plan provides an environmental rehabilitation and management plan for the contaminated sites that includes, a clear chain of command for all emergency activities, accountability for the performance of the decontamination work, well-defined task and operational risk assessment and reporting and record keeping requirements to track progress.	Ministry of Land, Water and Environment (MoLWE), Ministry of Energy and Mines (MoEM), Ministry of Labor and Social Welfare (MoLSW), Ministry of Local Government (MoLG), Ministry of Information (MoI), Ministry of Agriculture (MoA), Ministry of justice (MoJ), Ministry of Fisheries and Marine Resources (MoFMR), Civic societies.	2024 - 2025	30,000
Monitoring and evaluation of activities and progress				
TOTAL Budget (USD)				875,000
NB:10% of the budget comes from the Government of Eritrea in kind.				

# 7. MAINSTREAMING OF MERCURY PRIORITIES INTO EXISTING NATIONAL PLANS AND/OR PROGRAMS

As far as the national policy of Eritrea is concerned, the mainstreaming of mercury in the existing national plans or programmes is paramount. This could be appropriately carried out as outlined in Table 6.7.

Objectives/targets of the National Action Plan	Description	Intervention Plan/Activity Mainstreamed
<b>Indicative Development Plan (for Developing a Dynamic Economy and Better Quality of Life for all Citizens), 2009 - 2013</b>		
Training, Social Awareness and Responsibility Creation	This will help in building institutional capacity, sound management system for wastes management, reduction of mercury and raise the awareness of the public	<p>Intervention plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level</p> <p>Intervention Plan 2: Phasing-down and phasing-out import of Mercury-added Products</p> <p>Intervention Plan 3: Putting in place an environmentally sound management system for waste management, including mercury-containing waste</p> <p>Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining</p>
<b>Second Health Sector Strategic Development Plan, 2017 – 2021</b>		
<p>Capacity building for Health workers at health centre level</p> <p>Development of a comprehensive health law/act</p> <p>Equip and strengthen the capacity of laboratories on water quality monitoring</p>	<p>This is essential for controlling and alleviating the diseases caused by mercury pollution through building the capacity of health workers</p> <p>The development of health law encompasses the strengthening of legal pertaining to the heavy metals in general and mercury in particular</p> <p>The establishment of well-equipped laboratory for the analysis of water will be helpful in analysing the quality of water and afterwards in controlling the disposal or release of mercury to rivers</p>	<p>Intervention plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level</p> <p>Intervention Plan 2: Phasing-down and phasing-out import of Mercury-added Products</p> <p>Intervention Plan 3: Putting in place an environmentally sound management system for waste management, including mercury-containing waste</p> <p>Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining</p>
<b>National Gender Action Plan, 2015 – 2019</b>		
<p>Increase information and the level of awareness among the general public and authorities in order to increase the representation of women in power and decision-making</p> <p>Increase access to and accessibility of education and training in remote places, amongst nomadic and semi-nomadic communities and displaced people, in particular for women and girls</p> <p>Increased public awareness, especially on family laws and legislation</p> <p>Improved community access to water and enhance community participation in water management in order to increase sources of safe drinking water</p>	<p>Women are among the population at risk caused by emission or release of mercury. Thus, this strategic plan will promote awareness among the public in general and the most vulnerable groups the women in particular consequently reduces the health hazard caused by mercury release</p> <p>Education and training are also helpful in raising the awareness of the public which could be resulted in sound waste management system, including mercury-containing waste</p> <p>It is very much related to strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention</p> <p>The intervention plans 1-4 could be achieved when water management is practiced, and safe drinking water is ensured</p>	<p>Intervention plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level</p> <p>Intervention Plan 2: Phasing-down and phasing-out of the import of Mercury-added Products</p> <p>Intervention Plan 3: Putting in place an environmentally sound management system for waste management, including mercury-containing waste</p> <p>Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining</p>



**Enabling Activities to Review and Update the National Implementation Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs), 2019-2025**

<p>Strengthening of legislations on POPs chemicals</p> <p>Guidelines and standards related to the management of POPs</p> <p>Strengthening of technical infrastructure for POPs management</p>	<p>The strengthening of legislations concerning POPs chemicals will also be helpful in reducing the of mercury and mercury compounds emissions from factories/ industries</p> <p>This action plan is highly related and will positively contribute to environmentally sound management of wastes (including mercury containing wastes)</p> <p>By strengthening of technical infrastructure for POPs management results in the reduction of emissions of mercury and mercury compounds from different sources</p>	<p>Intervention plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level</p> <p>Intervention Plan 2: Phasing-down and phasing-out import of Mercury-added Products</p> <p>Intervention Plan 3: Putting in place an environmentally sound management system for waste management, including mercury-containing waste</p> <p>Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining</p>
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**Revised National Biodiversity Strategy and Action Plan for Eritrea, 2014-2020**

<p>Enhance implementation through participatory planning, knowledge management and capacity building</p> <p>Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity</p>	<p>This strategy is very much related to institutional capacity building for the integration of the Minamata Convention and for the sound management system that could include wastes</p> <p>The ecosystem could be safeguarded through awareness programs and reduction the emission of mercury and mercury compounds. It goes without saying that sound waste management for protection of the environment is paramount.</p>	<p>Intervention plan 1: Strengthening of the legal and institutional capacity building for the integration of the provisions of the Minamata Convention at national level</p> <p>Intervention Plan 2: Phasing-down and phasing-out import of Mercury-added Products</p> <p>Intervention Plan 3: Putting in place an environmentally sound management system for waste management, including mercury-containing waste</p> <p>Intervention Plan 4: Reducing the emissions of mercury and mercury compounds from cement clinker production facilities and industrial gold mining</p>
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### General Sites (With Links to Relevant Materials)

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## 9. ANNEXES

Annex 1 – List of stakeholder’s experts that were involved in both MIA and NAP projects

No	Name of Experts	Organization/Institution	Relevance on the project	Contact details
1	Mr. Kibrom Asmerom	Ministry of Land, Water and Environment	MIA and NAP project Supervisor	kibromaw@gmail.com
2	Dr. Aron Hailemicael	College of Science, EIT	Lead consultant of the MIA and NAP project	hharon2007@gmail.com
3	Mr. Habteab Tsige	College of Engineering, EIT	Lead consultant of mercury inventory and identification of emissions and resources	habteabeit@gmail.com
4	Eng. Bahreselam Sielu	College of Engineering, EIT	Task team of mercury inventory and identification of emissions and resources	
5	Eng. Belainesh Ghebretsaie (Ms)	Ministry of Trade and Industry	Task team of mercury inventory and identification of emissions and resources	eng.belaynesh@gmail.com
6	Eng. Teame Tekleab	Ministry of Land, Water and Environment	Project Coordinator of mercury inventory and identification of emissions and resources	teametek2016@gmail.com
7	Mr. Ermias Yohannes	Ministry of Energy and Mine	Lead Consultant of ASGM overview and NAP	ermias_yohannes@yahoo.com
8	Eng. Robel Kibrom	Ministry of Land, Water and Environment	Project Coordinator of ASGM overview and NAP	roki0404@gmail.com
9	Eng. Issac Sium	Ministry of Energy and Mine	Task team of ASGM overview and NAP	
10	Mr. Abreham Melak	Ministry of Justice	Lead Consultant of institutional, policy and regulatory assessment at national level	
11	Mr. Awet Tewelde	Ministry of Justice	Task team of institutional, policy and regulatory relevant to MIA assessment at national level	awetzcasablanca@gmail.com
12	Eng. Abeselom Haile	Eritrean Standard Institute	Task team of institutional, policy and regulatory relevant to MIA assessment at national level	abishaile12@gmail.com
13	Mr. Tuemzgi Tesfay	College of Agriculture, Hamelmalo	Lead Consultant of Mercury Contaminated sites	tumuzghitesfay7@gmail.com
14	Ms. Tsehay Melake	Ministry of Land Water and Environment.	Task team of Mercury Contaminated sites	gtsehaymelake@gmail.com
15	Mr. Biniam Ahferom	Ministry of Labour and Social Welfare	Task team of identification of population at risk and assessment of potential gender dimensions	
16	Dr. Leul Banteyrega	Ministry of Health	Task team of identification of population at risk and assessment of potential gender dimensions	
17	Mr. Yonotan Mesfin	MoF (Custom office)	Task team under Source of information for preparation of MIA and NAP	
18	Eng. Kibreab Ghebremariam	Ministry of Local Government	Task team under Source of information for preparation of MIA and NAP	



## Annex-2 Relevant Stakeholders

Relevant Stakeholders	Function	Institution/Agency/Company
Ministry of Agriculture	Data gathering	Government Institution
Ministry of Education	Data gathering	Government Institution
Ministry of Energy and Mines	Data gathering	Government Institution
Ministry of Information	Data gathering	Government Institution
Ministry of Finance	Data gathering	Government Institution
Ministry of Foreign Affairs	Data gathering	Government Institution
Ministry of Health	Data gathering	Government Institution
Ministry of Justice	Data gathering	Government Institution
Ministry of Local Government	Data gathering	Government Institution
Ministry of Land, Water and Environment	Data gathering	Government Institution
Ministry of Marine Resources	Data gathering	Government Institution
Ministry of Trade and Industry	Data gathering	Government Institution
Ministry of Transport and Communication	Data gathering	Government Institution
Ministry of Public Works	Data gathering	Government Institution
Maekel Region Environment Division	Data gathering	Government Institution
National Animal and Plant Health Laboratory, Ministry of Agriculture	Data gathering	Government Institution
National Statistics Office	Data gathering	Government Institution
National Union of Eritrean Women	Data gathering	NGO
National Union of Eritrean Youth and Students	Data gathering	NGO
Bisha Mining Share Company	Data gathering	Joint Venture Company
Eritrean Standards Institute	Data gathering	Government Institution
Eritrean National Mining Corporation	Data gathering	Government Institution
Zara Mining Share Company	Data gathering	Joint Venture Company
National Animal and Plant Health Laboratory	Data gathering	Government Institution
National Statistics Office	Data gathering	Government Institution
Hirgigo power plant	Data gathering	Government Institution
Cement factory	Data gathering	Government Institution
Azel Pharmaceutical Sh.Co	Data gathering	Joint Venture Company