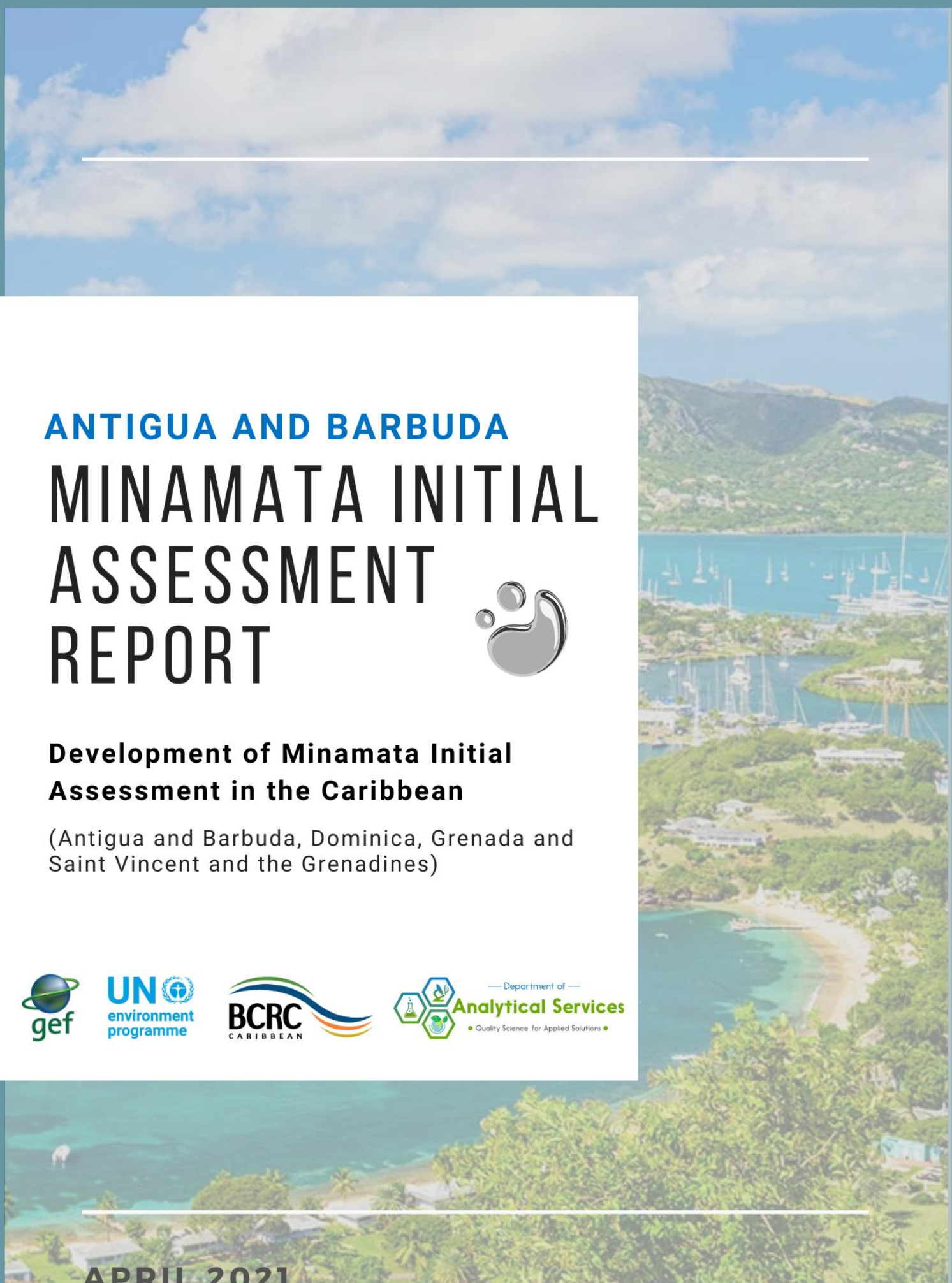

ANTIGUA AND BARBUDA

MINAMATA INITIAL ASSESSMENT REPORT

Development of Minamata Initial Assessment in the Caribbean

(Antigua and Barbuda, Dominica, Grenada and Saint Vincent and the Grenadines)

gef

UN environment programme

BCRC CARIBBEAN

Department of Analytical Services
Quality Science for Applied Solutions

APRIL 2021

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ANTIGUA AND BARBUDA MINAMATA INITIAL ASSESSMENT REPORT

PUBLISHED 2021

Prepared by the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean) under the GEF Project (GEFID9865): “Development of the Minamata Initial Assessment in the Caribbean (Antigua and Barbuda, Dominica, Grenada and Saint Vincent and the Grenadines)”.

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ABOUT THIS DOCUMENT

The Antigua and Barbuda Minamata Initial Assessment Report was developed under the project, "Development of Minamata Initial Assessment in the Caribbean: Antigua and Barbuda, Dominica, Grenada and Saint Vincent and the Grenadines".

The project is an enabling activity for the ratification and/or implementation of the Minamata Convention on Mercury. Funding was received from the Global Environment Facility (GEF) with the United Nations Environment Programme (UNEP) acting as the Implementing Agency and the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean) acting as the Executing Agency. Nationally, the project was executed by the Department of Analytical Services under the Ministry of Agriculture, Fisheries and Barbuda Affairs.

The development of the Report was guided by the BCRC-Caribbean with technical assistance from the Biodiversity Research Institute who was contracted for their consultancy services on the project. The report consists of an inventory of mercury releases primarily based on 2016 data. Data collection was conducted by a National Project Coordinator hired by the BCRC-Caribbean, and assessments and recommendations for the effective implementation of the Minamata Convention were provided.

This inventory was performed in accordance with United Nations Environment Programme's "Toolkit for identification and quantification of mercury releases", Inventory Level 2 (version November 2019).

The report also includes an assessment of the Policy, Legislative and Institutional Framework in relation to the implementation of the Minamata Convention on Mercury which was developed by the legal consultant, Environmental Advisors' Inc. Additional assessments and recommendations are outlined in chapters relating to populations at risk, education and awareness-raising strategies, and priorities for action to ensure the effective implementation of the Minamata Convention on Mercury.

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List of Abbreviations

ABS	Antigua and Barbuda Broadcasting Service
ABWREC	Antigua and Barbuda Waste Recycling Corporation
ALBA	Bolivarian Alliance for the Americas
APUA	Antigua Public Utilities Authority
BAT	Best Available Techniques
BCRC-Caribbean	Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean
BEP	Best Environmental Practices
BRI	Biodiversity Research Institute
EAG	Environmental Awareness Group
EAI	Environmental Advisors Inc.
CARDI	Caribbean Agricultural and Research Development Institute
CARICOM	Caribbean Community
CARPHA	Caribbean Public Health Agency
CBH	Central Board of Health
CCFLs and EEFLs	Cold Cathode Fluorescent Lamps and External Electrode Fluorescent Lamps
CDEMA	Caribbean Disaster Emergency Management Agency
CDB	Central Development Bank
CDM	Comprehensive Disaster Management
CFLs	Compact Fluorescent Lamps
CROSQ	CARICOM Regional Organisation for Standards and Quality
CSO	Civil Society Organisation
CYEN	Caribbean Youth Environment Network
EC	European Commission
ESM	Environmentally Sound Manner
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
g	Gram
g Hg/t	Gram of mercury per tonne
GDP	Gross Domestic Product
GEF	The Global Environment Facility
GIS	Geographic Information System
GLC	The Great Lakes Commission
Hg	Mercury
$HgCl_2$	Mercury Dichloride
HgO	Mercury Oxide
$HgSO_4$	Mercury Sulphate
HgS	Mercury Sulphide
HPMV	High-Pressure Mercury Vapour
HS	Harmonised System
ISLANDS	Implementing Sustainable Low and Non-Chemical Development in SIDS
kg	Kilogram

Kg Hg/y	Kilograms of mercury per year
LCD	Liquid Crystal Display
LFLs	Linear Fluorescent Lamps
LPG	Liquid Petroleum Gas
MAPs	Mercury-Added products
MEAs	Multilateral Environmental Agreements
mg	Milligram
mg Hg/t	Milligram of mercury per tonne
MIA	Minamata Initial Assessment
MIA Project	Development of the Minamata Initial Assessment in the Caribbean (Antigua and Barbuda, Dominica, Grenada and Saint Vincent and the Grenadines)
MOC	Mount Obama Committee
MONP	Mount Obama National Park
MSJMC	Mount St. John's Medical Center
NEMS	National Environmental Strategy
NGO(s)	Non-Governmental Organisations
NODS	National Office of Disaster Services
NPTEL	National Programme on Technology Enhanced Learning
NSWMA	National Solid Waste Management Authority
OAS	Organisation of American States
OECS	Organisation of Eastern Caribbean States
POPs	Persistent Organic Pollutants
ppm	Parts per Million
PTCCB	Pesticides and Toxic Chemicals Control Board
RSS	Regional Security System
SDGs	Sustainable Development Goals
SIDS	Small Island Developing State(s)
sq. km	Square Kilometres
t/y	Tonnes per year
Toolkit	Toolkit for Identification and Quantification of Mercury Releases
UN ECOSCO	United Nations Economic and Social Council
U.S. EPA	United States Environmental Protection Agency
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPOPs	Unintentional Persistent Organic Pollutants
VCM	Vinyl-Chloride-Monomer
WEEE	Waste Electrical and Electron Equipment
WHO	World Health Organisation
WIOC	West Indies Oil Company
WTO	World Trade Organisation
ww	wet weight
ZWAB	Zero Waste Antigua and Barbuda

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Acknowledgements

The provision of funding through the Global Environment Facility Trust fund to undertake the Minamata Initial Assessment (MIA) projects within the Caribbean region is a signal of commitment towards the global implementation of the Minamata Convention on Mercury. The contribution of the Caribbean region towards the global reduction in mercury levels within the environment, and the concomitant benefits to human health, must be recognised and the mechanism to foster said contribution is vitally important in realising the primary objective of the Convention to protect human health and the environment.

Antigua and Barbuda acceded to the Convention on 23 September 2016 and in so doing is committed to the obligations therein. As such, the Department of Analytical Services as the National Focal Point and agency responsible for national implementation activities is deeply committed to the strengthening of national capacity to address the reduction or elimination, where applicable, mercury containing products to prevent deleterious effects on the environment and to human health.

In recognition of this national commitment, Antigua and Barbuda has provided the necessary information, data and assessment of institutional capacity towards meeting its obligations. The MIA report provides an overview of the national context as it relates to major sources of mercury through the application of the United Nations Environment Program (UNEP) Toolkit for the Identification and Quantification of Mercury Releases. Further, responsible entities and modalities to address mitigation measures in the context of the Convention have been identified.

Antigua and Barbuda is deeply committed to the engagement of national processes to address the findings of the MIA report and to devise the national framework for the management of sources of mercury and of chemicals and waste in general. We further recognise the importance of a regional coordinated approach to the management of mercury and appreciate the efforts of the Basel Convention Regional Centre for Training and Technology Transfer (BCRC Caribbean) in harmonising the Caribbean regional approach.

It is our sincerest commitment to adhere to the tenets of the Convention and to foster regional coordination in the management mercury in its various forms. Moreover, we remain committed to the integration of scientific knowledge into the decision-making process.

Dr Linroy Christian

National Focal Point

Chemicals and Waste Management

Executive Summary

On September 23, 2016, the Government of Antigua and Barbuda acceded to the Minamata Convention on Mercury, a multilateral environmental agreement that aims to protect human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds.

In order to assess the priorities for the implementation of the Minamata Convention's obligations, the Government of Antigua and Barbuda participated in the Global Environment Facility funded project, "Development of Minamata Initial Assessment in the Caribbean (Antigua and Barbuda, Dominica, Grenada and Saint Vincent and the Grenadines)" (MIA Project). The MIA Project aims to facilitate the ratification and early implementation of the Minamata Convention on Mercury through the use of scientific and technical knowledge in participating countries. The MIA Project outputs within each of the project countries were overseen by respective National Working Groups comprising of representatives from relevant ministries and institutional bodies.

Under the MIA Project, a national inventory of the major sources of mercury releases and emissions was conducted using the "Toolkit for Identification and Quantification of Mercury Releases" (Toolkit), made available by the Chemicals Branch of the United Nations Environment Programme. This project utilised the Level 2 Toolkit as it provided a more comprehensive assessment of mercury releases. It should be noted that in the Toolkit, the term "releases" is used to cover mercury emissions to air as well as releases to water, land and other output pathways. The methodology is based on mass balances for each mercury release source sub-category and so, estimations provided by the Toolkit have various uncertainties and complexities involved.

For Antigua and Barbuda, the inventory primarily used 2016 data obtained through research, interviews, and stakeholder questionnaires. However, for some sub-categories, data from the year 2016 was not available and so previous years or default calculations were used to develop estimates. Default calculations were based on the Toolkit assumptions and may have resulted in over- or under- estimations of the actual mercury input. Data gaps were also noted for some sub-categories where no estimations could be made such as the use and disposal of cosmetics containing mercury and the informal dumping of waste. The completed inventory Toolkit spreadsheet; a listing of national project stakeholders; and templates of questionnaires used for data collection, are included as Annexes to this document.

RESULTS OF THE INVENTORY OF MERCURY RELEASES

Based on the data available, approximately 43.5 kilograms (kg) of mercury (Hg) were determined to be released in Antigua and Barbuda in 2016. The estimated mercury releases by source and by output through various release pathways identified are illustrated in Figures 1 and 2. The most significant source of mercury releases was found to be the consumption of products with intentional use of mercury throughout their use and disposal. This category accounted for 29.6% of estimated national mercury releases due to the use and disposal of mercury containing electrical switches and relays, thermometers, batteries and lighting devices, which accounted for inputs of approximately 10.77 kg, 1.86 kg, 0.23 kg and 0.04 kg of

mercury per year (kg Hg/y) respectively, resulting in a total of 12.90 kg Hg/y. Of this

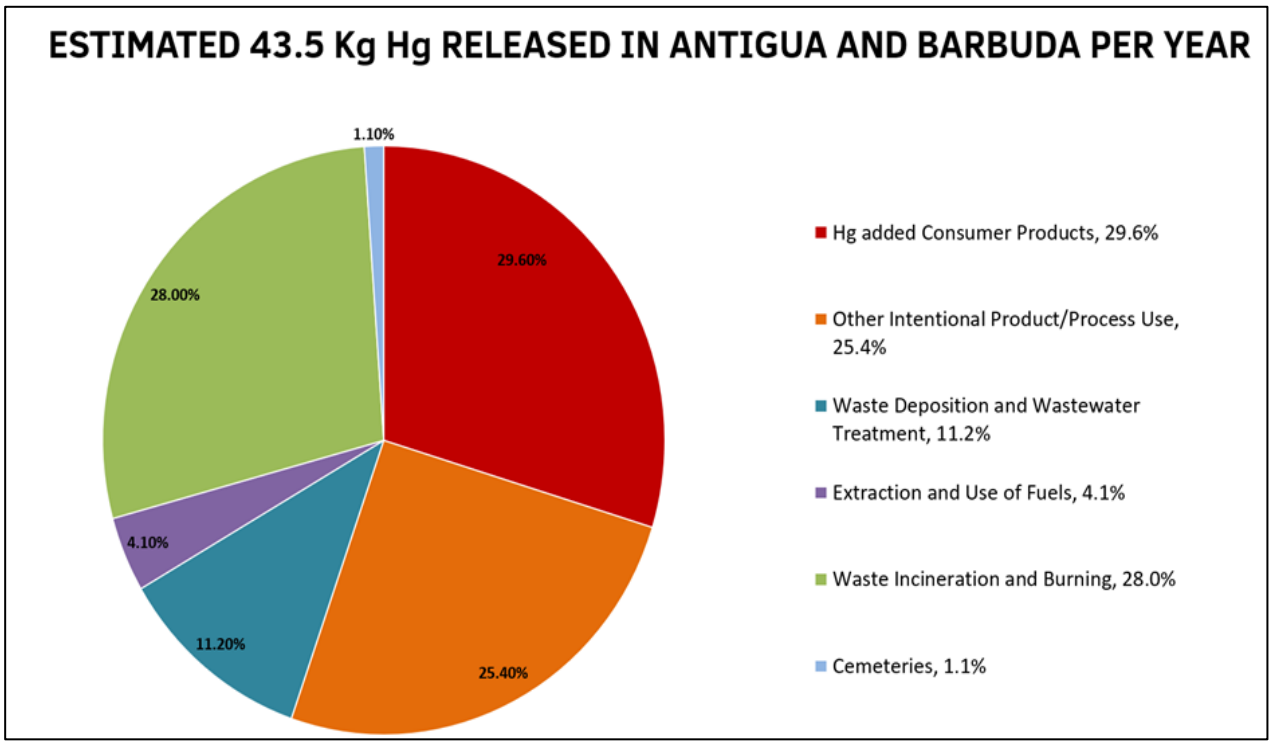

Figure 1: Estimations of total releases from the major sources of mercury identified in the mercury inventory conducted using primarily 2016 data for Antigua and Barbuda

total, the majority (10.00 kg Hg/y) was estimated to be released to the general waste output pathway with minor releases to land, water and air. These products are not produced within Antigua and Barbuda but rather imported from countries such as the United States of America and China.

The second largest estimated source of mercury releases was found to be from waste incineration (28.0%) with the sub-categories: incineration of medical waste (0.19 Kg Hg/y) and informal burning of medical waste (12.00 Kg Hg/y) collectively accounting for the highest source category releases to the air output pathway.

The third highest source of mercury releases was from the category, Other Intentional Product/Process Use, which accounted for 25.4% of total estimated releases nationally. This category accounted for the largest releases to water, by-products and impurities and sector-specific treatment and disposal and referred to sources such as Laboratory Chemicals and Equipment (4.91 kg Hg/y), Dental Amalgam Fillings (3.91 kg Hg/y) and Manometers and Gauges (2.25 Kg Hg/y).

Minor releases were also estimated from the categories Waste Deposition and Wastewater Treatment (referring to releases from a Controlled Landfill); Extraction and Use of Fuels/Energy Sources (referring to the combustion and use for transport and other uses of mineral oils); and Cemeteries. Regarding mercury

stockpiles, supplies or trade, there is no notable activity in Antigua and Barbuda.

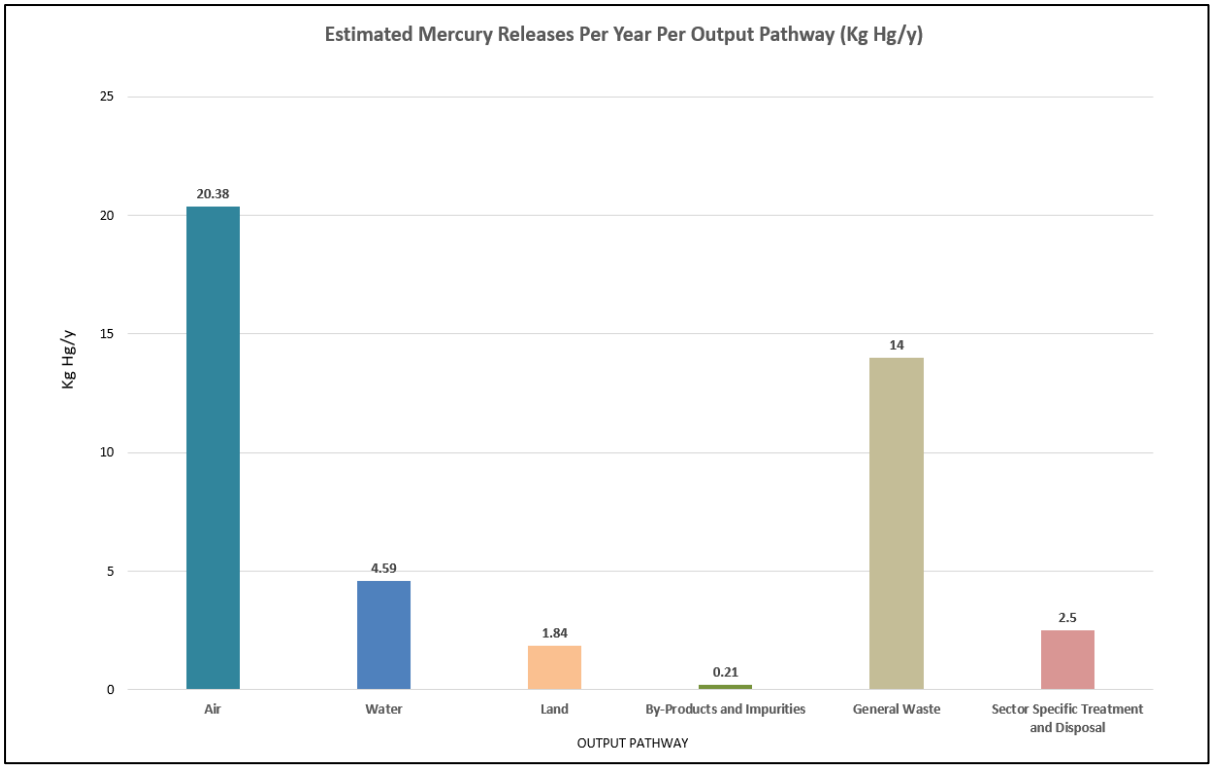

Figure 2: Estimations of releases to each output pathway from the major sources of mercury identified in the mercury inventory conducted using 2016 data for Antigua and Barbuda

Major Findings of the Policy, Regulatory and Institutional Framework Assessment

An assessment of the policy, regulatory and institutional framework related to mercury management was conducted in September 2019 under the MIA Project by legal consultant, Ms. Judy Daniel, Environmental Advisors Inc.

The legal review concluded that while the existing regulatory framework contains some provisions for the implementation of mercury management, overall, the framework is broad and fragmented. Improving the national policies and legislation can include developing a mechanism for ensuring collaboration between the various plans, with guidelines crafted on how to involve all relevant stakeholders. The technical infrastructures for analysing and monitoring chemicals must also be strengthened. Policies and legislation should be subjected to monitoring and evaluation to assess the extent to which they are being effectively implemented. Protocols for the various activities for the life cycle management of chemicals should be developed, adopted, and subject to regular review and revision.

Specific recommendations for improvement include establishing a holistic chemicals management policy that establishes comprehensive strategies on mercury risks by outlining what Antigua and Barbuda hopes to achieve under its chemicals management structure and clarifying the methods and principles that it will use to achieve them. Under the regional project that Antigua and Barbuda is also participating in called,

"Development and Implementation of a Sustainable Management Mechanism for Persistent Organic Pollutants (POPs) in eight (8) Caribbean Countries" (GEF 5558) a Regional Model Integrated Chemicals Management Act was developed which is founded on an assessment of the existing legislation and practices with respect to chemicals management in the participating countries, in order to identify cross-cutting issues which must be taken into account in developing an appropriate regulatory framework for chemicals management including mercury in the Caribbean region. It is recommended that this Draft Bill be consolidated with other related policies and laws such as the Pesticides and Toxic Chemicals Act, Standards Bill and National Solid Waste Management Act to ensure effective and holistic implementation of chemicals management.

Amendments and additions to other legislative measures were also recommended such as:

- Development of standards for import of potentially mercury-added products by the Bureau of Standards and the prohibition of specified mercury-added products by the Comptroller of Customs under the Customs (Control and Management) Act, 2013;
- Strengthening of the Environmental Protection and Management Act with provisions to regulate and monitor releases of mercury and its compounds to land and water, to enact the polluter pays principle to prevent the discharge of mercury and its compounds from identified point sources;
- Updating the National Environmental Management Strategy and Action Plan (2004-2009) to include a strategy for managing hazardous wastes such as mercury.
- Including wastes containing mercury in the Draft National Solid Waste Management Authority Strategic Plan (2014-2029) before enacting the Plan.
- Including regulations and guidelines (based on BAT/BEP) for the management and disposal of mercury containing products and wastes to the National Solid Waste Management Authority Act.

Responsibilities for waste and chemicals management and by extension, mercury management, in Antigua and Barbuda are shared among several governmental bodies and some private sector entities with the Department of Environment being vested with oversight capabilities. The Department of Analytical Services is the entity responsible for the implementation of compliance activities under the Minamata Convention.

Chemicals are placed within the remit of institutions based on the purpose of the chemicals as used within the sector being regulated under the law. In light of this, the institutional framework lacks a holistic regulatory approach by which all chemicals are subject to a central institution. As a result, decision-making is hampered by differing priorities across institutions for chemical management.

Scarce human, material and financial resources limit efforts to effectively implement, monitor and enforce existing laws and regulations and improve national environmental and chemicals management. Limited staff are assigned to effectively manage these sectors. Relevant legislations, including the Pesticides and Toxic Chemicals Control Act, the Environmental Protection and Management Act and the Public Health Act, account for the appointment of officials to aid in monitoring and enforcement; however, the provisions under these legislations are broad and do not specify standards, permissible limits or guidelines which should be followed, therefore limiting

the effectiveness of appointed officers. Additionally, national allocation of funds for environmental protection are significantly lower than that in other sectors.

To improve upon the institutional capacity, the following recommendations are made:

- Make provision for a Chemicals Management Authority that is governed by a Board comprising the members of the Pesticides and Toxic Chemicals Board, Customs and Excise Division, Public Health, Solid Waste Management Authority and the Bureau of Standards. The Authority will be responsible for the management of all chemicals in Antigua and Barbuda. The role of the National Implementing Committee established under the Environmental Protection Act, 2013 should also be taken into account in this decision;
- Establish the Analytical Laboratory Services in a separate legislative instrument.
- Establish a Caribbean Data Collection and Monitoring Network that stores original raw data and integrates other data collection systems as far as possible among other things.

Strategies for Identification of Contaminated Sites and Assessment of Risks to Human Health

The development of a strategy to identify sites contaminated by mercury was initiated under this project through a technical consultancy with The Biodiversity Research Institute. National-scale data on potential point sources of mercury and ecosystems that might be sensitive to mercury inputs were incorporated into a model to help identify areas of the country that are sensitive to mercury inputs from a standpoint of methylmercury generation and availability.

In Antigua and Barbuda, watershed and catchment areas were analysed, respectively. Watershed Hg Sensitivity was rated on a scale of 0.0 (not sensitive to methylation of mercury) – 1.0 (most sensitive to methylation of mercury).

Neither island was found to have high watershed sensitivities between 0.8 – 1.0. However, 22.4% (57) and 19.5% (8) of the watersheds in Antigua and Barbuda, respectively, had sensitivities between 0.6 – 0.8.

The variations in watershed sensitivities to the methylation of mercury in Antigua and Barbuda were found to be driven by the spatial distribution of mangroves. In Barbuda, the presence of swamps was a secondary contributor to watersheds with higher sensitivities. Potentially mercury contaminated sites such as landfills and dumpsites on both islands are located within watersheds that were found to have sensitivities between 0.6 – 0.8.

The results from the rapid assessment can be used to provide information on the potential of relating land coverage to mercury exposure risk. To further optimise the analysis, the presence and location of additional potential sources of mercury should be verified by relevant authorities in Antigua and Barbuda.

Exposure to elemental mercury and mercury compounds can pose a higher risk to certain populations that are more sensitive to their effects or have an increased frequency of exposure. These groups include pregnant women and women of childbearing age, fetuses, newborns and young children, individuals with health-related preconditions, and individuals who consistently use mercury-added products such as some skin-lightening creams. Also at risk are people living in areas that are more susceptible to environmental contamination by mercury

and workers exposed to mercury on a regular basis including dental and medical professionals and assistants, waste handlers, environmental officers, firemen and first responders, laboratory workers and other industrial workers. In Antigua and Barbuda, a rapid gender analysis was conducted which found that a higher percentage of females work in the medical, dental and waste sector and as such, may have a higher likelihood of mercury exposure. Some research has shown that the use of skin lightening creams by women with children have led to greater risks of mercury transfer to their children.

Populations with a regular diet of contaminated high trophic level aquatic organisms are also at risk of mercury contamination. A rapid assessment of mercury concentrations in opportunistic samples of fish was conducted in Antigua and Barbuda by the Biodiversity Research Institute. Overall, it was found that some regularly and commercially harvested seafood from Antigua and Barbuda can be safely consumed either on a daily or weekly basis, as they may have average mercury concentrations under 0.22 parts per million, wet weight, (ppm, ww). On the other hand, mercury concentrations may be higher in large pelagic, predatory and long-lived species like the Blue Marlin and Great Barracuda. Mean mercury levels in these larger species may exceed 0.22 ppm, and it is recommended that human consumption be limited to only one meal per month as they are riskier choices. Fish and seafood with Hg concentrations over 0.95 ppm, ww should not be consumed regularly in Antigua and Barbuda.

The monitoring of mercury in fish and seafood in Antigua and Barbuda needs to be improved to ensure accurate exposure estimates over time, and to inform advisories on healthy dietary practices throughout the country.

Awareness-raising Strategies for Mercury Management

Under the MIA Project, stakeholders from the relevant government sectors such as waste and health as well as non-governmental organisation (NGO) stakeholders have been made aware of the areas of focus for sound mercury management throughout the project through working group meetings. In addition to the National Minamata Initial Assessment Report and discussions, a communications package was developed that includes many technical briefing documents which will provide information to all key stakeholders and government officials. These documents provide the results of the different components of the project, including the results of the add-on sampling initiatives. These materials will assist in high-level stakeholder engagements or in drafting relevant cabinet briefing notes to promote the enforcement of the Minamata Convention.

Based on the materials produced, a communication strategy for mercury awareness was developed for Antigua and Barbuda that included the use of social media campaigns; Public Service Announcements via television and radio; involvement in environmental campaigns and events; partnering with NGOs, Youth Groups or other project initiatives; engaging local health institutions and store owners; engaging students at primary and secondary level; engaging policy makers.

The communication strategy can be tailored to meet the priorities of Antigua and Barbuda, given the available resources, collaborations and network in the country.

Priority Areas for Consideration in the Implementation of the Minamata Convention

In addition to the legislative and institutional recommendations for consideration in the implementation of the Minamata Convention, other practical considerations may include:

- Promotion of mercury-free consumer products which are already widespread on the market.

- Development of proper separation methods for the disposal of mercury-added products both at the household consumer level and in landfill management procedures. The Government should ensure that the public has access to environmentally sound facilities/locations that could aid in the disposal process, as well as information and guidelines on disposing mercury added products.

- Strengthening of the national capacity to test and monitor mercury in human health and the environment.

- Integration of gender into mercury abatement projects.

These recommendations can be further achieved through Antigua and Barbuda's involvement in several national and regional initiatives.

Under the 2019 second round of the Specific International Programme was awarded funding for "Facilitating capacity-building with technical assistance and technology transfer for managing mercury in the Caribbean" in which a Caribbean Region Mercury Monitoring Network will be set up. The Network will ensure the strengthening of national laboratory capacity and assess mercury in air deposition, fish, birds, humans and cosmetics.

As part of the approved GEF Small Grants Programme, the project entitled, "Contribution towards ratification and implementation of the Minamata Convention on Mercury and towards phasing out of mercury-added products in Antigua and Barbuda" an objective specifically towards the national increase in public awareness about the dangers of mercury through engagement of stakeholder such as Customs and persons in the waste sector is included. Collaboration between the lead agency of this project, the Zero Waste Antigua and Barbuda Group, and the MIA project will be carried on throughout 2020-2021 for the execution of the communication strategy.

Under the GEF Programme, Implementing Sustainable Low and Non-Chemical Development in SIDS (ISLANDS) of which Antigua and Barbuda is a participant, sound management of chemicals and waste will be addressed through strengthening the capacity of sub-national, national and regional institutions and strengthening the enabling policy and regulatory framework in project countries. Mercury management will be largely addressed under this Programme planned for 2021 - 2026.

INTRODUCTION

Mercury in the Environment

Mercury (Hg) is a highly toxic heavy metal, which occurs naturally in the Earth's crust. It is commonly found as a reddish-brown compound called cinnabar: mercury sulphide (HgS) and can be released into the environment via natural processes or anthropogenic releases. Once released and mobilised into the environment, mercury cannot be destroyed and will cycle between air, water and land.

Some of the natural processes that release mercury into the environment include volcanic eruptions, weathering of mercury-containing rock materials, forest fires, and ocean vents (*Figure 3*). Human activities have significantly contributed to major increases in mercury levels in the environment. These activities include mining, combustion, production of metal from ores, the intentional use of mercury in products and processes and the remobilisation of previous mercury releases. Anthropogenic sources can account for 30% of the mercury emissions in the atmosphere, while 60% comes from re-emissions of mercury already in the environment, mostly as a result of previous human activity and the remaining 10% of the emissions is from natural sources. (UNEP, 2019d).

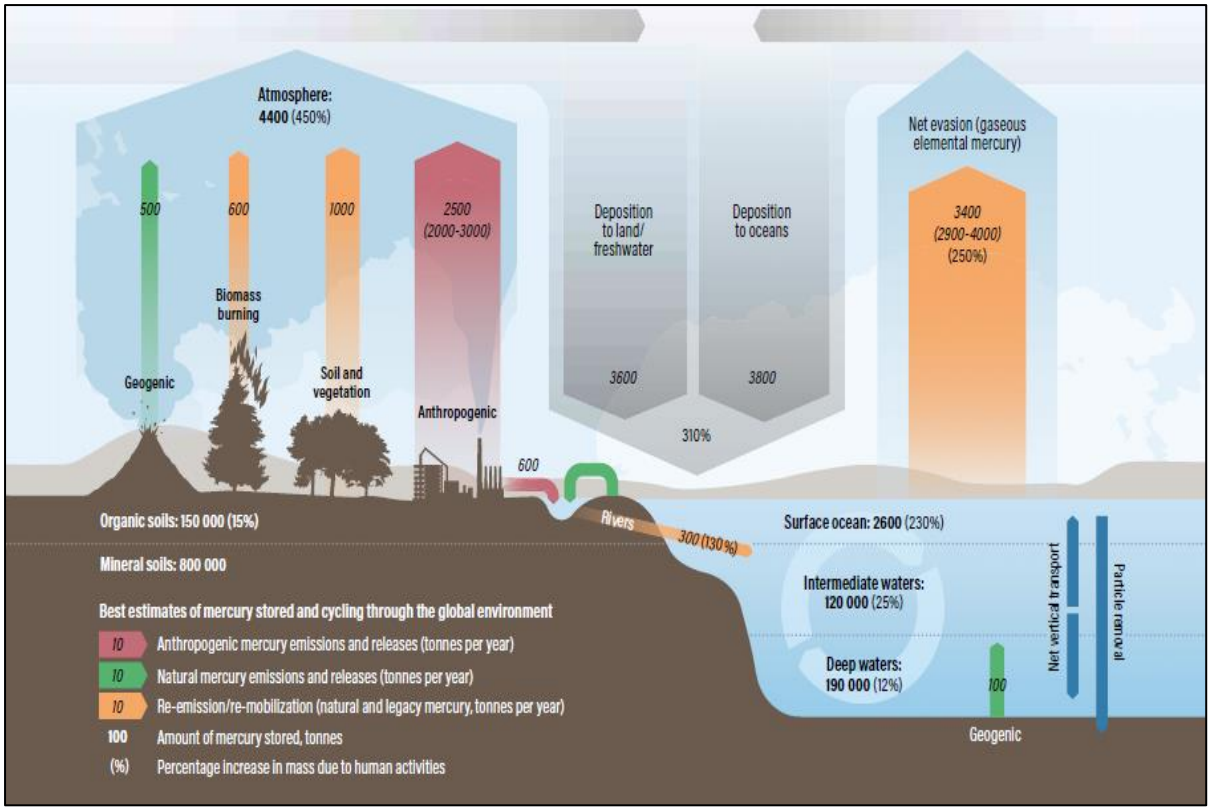

Figure 3: The Global Mercury Budget as it relates to the Mercury Cycle (Values in tonnes of mercury) (Source: UNEP, 2019d)

Mercury possesses unique properties; for example: it has a high density, is liquid at room temperature and can combine with most metals to form alloys called amalgams. With a change in temperature, liquid elemental mercury expands and contracts very precisely yet with a change in atmospheric pressure, maintains its

volume. These unique properties have made mercury very useful in devices designed to measure temperature or pressure, and it is included as a component of many products and processes.

The World Health Organisation (WHO) has listed mercury as one of the top ten chemicals of major health concern (WHO, 2017). In its liquid, inorganic form, mercury poses less of a risk but when deposited into water bodies, it can be converted into its more toxic methylated form through the action of bacteria. This highly toxic organic form of mercury can bioaccumulate and biomagnify in the food chain and can result in different concentrations of mercury in food resources that can affect humans and wildlife.

Inorganic mercury can enter the human body through inhalation or direct contact with the skin, while organic methylmercury can enter through ingestion of contaminated aquatic species. Exposure to mercury is detrimental to human health as it can damage the central nervous system and affect numerous organs, resulting in neurological and behavioural disorders. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches, and cognitive and motor dysfunction (UNEP, 2019a). More severe effects are typically seen in fetuses and young children due to their vulnerable developing systems.

According to the updated Global Mercury Assessment which assessed 2015 global mercury inventory emissions, it was noted that artisanal and small-scale gold mining contributed the most to mercury emissions (approximately 38% of total) as large amounts of elemental mercury are often used in the process. Other key sources included coal combustion, non-ferrous metal production and cement production. Emissions from the disposal of mercury-added products (MAPs), such as thermometers and compact fluorescent lightbulbs accounted for 7% of global emissions. For Central America and the Caribbean region, an estimated 45.8 tonnes of mercury per year were estimated to be emitted accounting for 2.1% of global emissions (UNEP, 2019d). Although the releases of mercury through anthropogenic activity in the Caribbean region is expected to be relatively small, mercury released by other countries around the globe has the ability for long-range transport in the atmosphere and a global approach to mercury management is needed to adequately address its impacts.

Minamata Convention on Mercury

In order to address the negative impacts posed by the release of mercury, a global treaty called the Minamata Convention on Mercury was developed. The objective of this Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

The text of the Minamata Convention was adopted on October 10, 2013 and the Convention entered into force on August 16, 2017. The Convention regulates, *inter alia*, mercury supply, sources and trade; mercury-added products and processes; interim storage and disposal of mercury, its compounds and mercury waste; and the emissions and releases of mercury.

In the Caribbean region, the countries that are Party to the Minamata Convention as of September 2020 are:

- Antigua and Barbuda;
- The Bahamas;
- Cuba;
- Dominican Republic;
- Guyana;
- Jamaica;
- Saint Kitts and Nevis;

- Saint Lucia; and
- Suriname.

Antigua and Barbuda acceded to the Minamata Convention on September 23, 2016.

Project Background

Through Article 13 of the Minamata Convention, a financial mechanism was identified to support countries with implementation of the Convention. This included support from the Global Environment Facility Trust Fund for the development of a Minamata Initial Assessment (MIA), which is an enabling activity to determine the national mercury inventory in a country and what is needed to ratify and/or implement the Convention.

Antigua and Barbuda's Minamata Initial Assessment is facilitated through the project entitled the "Development of Minamata Initial Assessment in the Caribbean (Antigua and Barbuda, Dominica, Grenada and Saint Vincent and the Grenadines)" (MIA Project) which is funded by the Global Environment Facility (GEF), implemented by United Nations Environment Programme (UNEP) and executed by the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean). The national focal point for implementation of the Convention and supervision of the project nationally is Dr. Linroy Christian, Director of the Department of Analytical Services under the Ministry of Agriculture, Fisheries and Barbuda Affairs.

The MIA Project aims to facilitate the ratification and early implementation of the Minamata Convention on Mercury using scientific and technical knowledge in conducting an inventory of mercury releases (and emissions[1]) in the respective countries. The development of an inventory of mercury releases will inform participating countries of their national mercury sources and subsequently assist in identifying actions to increase their capacity in mercury management.

The inventory was conducted with the use of the "Toolkit for Identification and Quantification of Mercury Releases" (Toolkit), made available by the Chemicals Branch of UNEP. The Toolkit is designed to produce a simple and standardised methodology and database to inform the national mercury inventory. It outlines a UNEP-recommended procedure to facilitate the development of consistent and comparable source inventories. The steps involved include:

1. The identification of the main mercury source categories present in the country;
2. The refining of the identified mercury source categories into further sub-categories in order to determine the individual activities that potentially release mercury, and gathering of qualitative information on the activities;
3. The development of a quantitative inventory; the Inventory Level 2 version of the Toolkit was utilised in this MIA Project as it provided a more comprehensive look at the releases of mercury. Estimations are calculated via equations and procedures specific to the source types identified; and

[1] Under the Minamata Convention, the term "releases" is typically related to mercury released to land and water while the term "emissions" refers to mercury released to air. Under the UNEP Toolkit, "releases" is used to describe mercury released to all media, including air. For this report, the term "mercury releases" will be used predominantly as described under the UNEP Toolkit.

4. The compilation of the standardised mercury inventory and identification of data gaps which will build on the country's knowledge base on mercury.

It is important to note that in calculating estimations of mercury releases using the Toolkit, there may be various uncertainties and complexities involved. As such, for each mercury source sub-category present, there will be an estimate of releases to all media where data is sufficient and an indication of the likely magnitude if full data is unavailable. Major data gaps will also be identified. These considerations will assist in the interpretation of results and prioritisation of future actions.

Other aspects of the MIA Project included an assessment of the legislation, policies and institutional capacity available to implement the Convention; identification of possible mercury contaminated sites and hotspots; and capacity building, technical assistance and awareness-raising activities in relation to mercury management. Further details on the project outputs are detailed in Table 1.

For the development of project activities, consultants were hired. These included a National Project Coordinator responsible for the in-country data collection and stakeholder engagement; technical experts on the mercury inventory development, The Biodiversity Research Institute (BRI); legal experts, Environmental Advisors Inc. (EAI); gender expert, Ms. Candice Ramessar; and awareness raising consultants, Bloom Management Inc. and Efoundry Digital Agency Ltd.

In order to acquire information and develop a comprehensive national mercury management strategy for mercury releases, a national working group of key stakeholders, which included professionals from the waste management, energy, health and environmental sectors, was formed (Annex 1).

Table 1: Outline of project components and expected outputs as stated in the MIA Project document

Project Component	Project Output
Global technical support and capacity building for MIAs development	1.1 Technical assistance provided to participating countries to develop the MIAs while building sustainable foundations for their future implementation of the Minamata Convention
Development and validation of the Minamata Initial Assessments	2.1 Identified and strengthened Project Steering Committee and National Coordination Mechanisms dealing with mercury management that will guide the project implementation
	2.2 National institutional and regulatory frameworks and national capacities on mercury management assessed
	2.3 National inventories of mercury sources and releases developed using the UNEP Mercury Toolkit Level II and strategies for the identification of mercury contaminated sites developed
	2.4 Challenges, needs and opportunities to implement the Minamata Convention assessed and recommendations to ratify and implement the Minamata Convention developed
	2.5 MIA validated by national stakeholders
Monitoring and Evaluation	3.1 Status of project implementation and probity of use of funds accessed on a regular basis and communicated to the GEF

Project Component	Project Output
	3.2 Independent terminal evaluation developed and made publicly available

Chapter 1: National Background Information

1.1 Geography and Population

The twin-island state of Antigua and Barbuda (Figure 4) is located in the northern region of the Lesser Antilles between the Caribbean Sea and the Atlantic Ocean. The island of Antigua is located 17° 10' N and 61° 55' W of the equator, while Barbuda lies twenty-five miles north of Antigua and 17° 35'N and 61° 48' W of the equator.

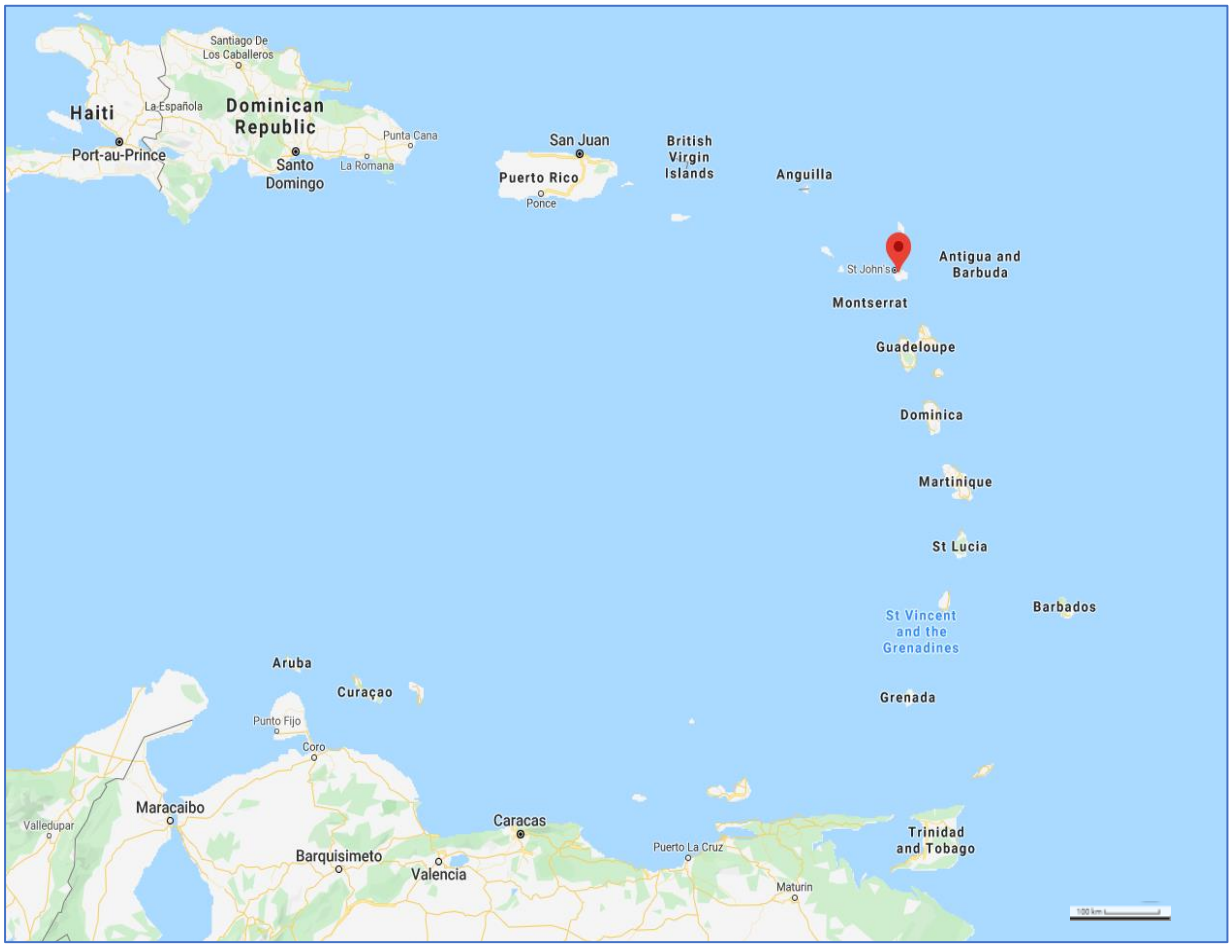

Figure 4: Location of Antigua and Barbuda within the Caribbean (Source: Google Maps, 2020)

The islands share a total area of 442 square kilometres (sq. km) where Antigua, the larger island, is 280 sq. km and Barbuda, 161 sq. km. The nation is also made up of a small uninhabited island called Redonda which makes up the remaining 1.6 sq. km.

Antigua comprises of relatively flat central plains with rolling limestone hills and valleys in the north and east while some mountainous volcanic areas exist on the south side of the island. The highest point on the island is Mount Obama which reaches up to 402 metres. Barbuda is relatively flat with its highest hill being approximately 40 metres tall.

The country's tropical maritime climate comprises of two seasons; the dry and wet season. The dry season generally runs from January to mid-April while the wet

season runs from June to mid-November. Tropical cyclone activity in the Atlantic occurs during the wet season which results in an increased incidence of minor and major tropical storms and hurricanes. In September 2017, Hurricane Irma caused large-scale destruction to Barbuda's infrastructure and landscape.

According to the Antigua and Barbuda 2011 Population and Housing Census (Government of Antigua and Barbuda, 2011), the total estimated combined population for Antigua and Barbuda was 87,774 in 2011. The most recent population data obtained from the World Bank Group estimated the 2018 population to be 96,286 (World Bank Data Group, 2019). St. John's serves as Antigua's capital and approximately 45% of the country's residents live in rural areas surrounding the capital, while 35% live in the urban part of St. John's, and 3% in Barbuda. The gender ratio is 91.4 males to every 100 females (Government of Antigua and Barbuda, 2011). English and Antiguan Creole are the two main languages spoken in Antigua and Barbuda, but English is the official language of the nation.

1.2 Political, Legal and Economic Profile

After many years of being colonised by the British since 1667, Antigua and Barbuda gained its independence from Britain on November 1, 1981. The nation is described as a constitutional monarchy where Queen Elizabeth II of England is the head of state and is represented by the Governor General.

The bicameral legislature is composed of a seventeen (17)-seat House of Representatives where members are elected every five (5) years and appointed by the Senate (Commonwealth Secretariat, 2019). The Senate consists of 17 members, one (1) of which is appointed at the Governor General's discretion, eleven (11) of which are appointed by the Governor General on the advice of the Prime Minister, four (4) by the leader of the opposition and one (1) by the Barbuda Council. The Barbuda Council is a principal organ of the local government in Barbuda.

Antigua and Barbuda is a member of some regional and sub-regional organisations including the following:

- The Caribbean Community (CARICOM), which rests on four main pillars: economic integration; foreign policy coordination; human and social development; and security.
- The Organisation of Eastern Caribbean States (OECS), an inter-governmental organisation dedicated to economic harmonisation and integration, protection of human and legal rights, and the encouragement of good governance between countries and dependencies in the Lesser Antilles in the Eastern Caribbean. It also performs the role of spreading responsibility and liability in the event of natural disaster.
- The Caribbean Public Health Agency (CARPHA), a regional inter-governmental agency with the purpose of drawing together and building on public health knowledge and expertise across the Caribbean, preventing duplication of effort and resources. This will facilitate a coordinated approach to public health issues including managing the risk of disease outbreaks in the Caribbean region.
- The United Nations (UN), an intergovernmental organisation tasked to promote international

cooperation and to create and maintain international order.

- The CARICOM Regional Organisation for Standards and Quality (CROSQ), a regional inter-governmental organisation established to facilitate the development of regional standards, promote the harmonisation of metrology systems and support the sustainable production and trade of goods and services.
- The Caribbean Disaster Emergency Management Agency (CDEMA), a regional inter-governmental agency for disaster management in the Caribbean Community. CDEMA is the regional disaster management body playing the role of facilitator, driver, coordinator and motivating force for the promotion and engineering of Comprehensive Disaster Management (CDM) in the region.
- The Bolivarian Alliance for the Americas (ALBA), an intergovernmental organisation based on the idea of the social, political and economic integration of the countries of Latin America and the Caribbean.
- The Commonwealth of Nations, an intergovernmental organisation of fifty-three (53) member states that are mostly former territories of the British Empire. The Commonwealth operates by intergovernmental consensus of the member states, organised through the Commonwealth Secretariat and NGOs, organised through the Commonwealth Foundation.
- The World Trade Organisation (WTO), an intergovernmental organisation that regulates international trade.
- The Regional Security System (RSS), an international agreement for the defense and security of the eastern Caribbean region.
- The Food and Agriculture Organisation (FAO) of the United Nations, a specialised agency that leads international efforts to defeat hunger.

Tourism continues to serve as the main source of revenue for Antigua and Barbuda. It accounts for about 60% of the islands' Gross Domestic Product (GDP), while the remaining 40% is attributed to investments (CIP, n.d).

Antigua and Barbuda's economy depends heavily on the arrivals of tourist from the United States of America, Europe and Canada which has been affected in recent years by the 2009 economic recession as well as damage to infrastructure and other tourist amenities caused by hurricanes have also affected this sector. The nation focuses heavily on expanding various amenities within the tourism industry in order to increase its GDP. Recently, the nation invested about US$45 million in the expansion of the airport and as of last year, began to reap the benefits. According to Antigua and Barbuda Tourism Officials (interviewed in 2018), air arrivals, sea arrivals and hotel occupancy grew by 7%, 11.57% and 8.6% respectively. Antigua and Barbuda will continue to support the tourism industry as it is the main revenue generator within the nation.

As of 2014, the government has introduced the Citizenship by Investment Program as a means of boosting the country's economic status.

The manufacturing and industry sector is a relatively small sector, which includes

pottery, distilled liquors and textiles. The manufacturing exports include handicrafts, electronic components and bedding. This sector contributes to approximately 1.85% to the overall GDP of the country (Commonwealth Secretariat, 2019).

Agriculture, Livestock and Forestry accounts for 0.80% of the total GDP and focuses on small-scale farming within the domestic market, therefore, the country is heavily reliant on the importation of foodstuff.

Antigua and Barbuda was the first country to license online casino sites in 1994 and started the internet gambling and betting revolution (GamingZion, 2019). All forms of gambling including sports are legalised and attracts many customers from Europe and other countries. The monies generated from this industry have contributed to the development of infrastructure within the nation (Betting Planet, 2014) and is duly regulated by the Financial Services Regulatory Commission (FSRC).

1.3 Environmental Overview

Antigua and Barbuda is faced with many environmental issues that have repercussions on different sectors within the society and therefore are deemed as national priorities. These include pollution, land degradation, uncontrolled roaming and grazing of stray livestock, inadequate land use planning, the introduction of invasive species, high-energy costs, and degradation of marine coastal resources.

The nation's plan to manage the environmental issues is outlined in the Environmental Management Strategy and Action Plan, 2004-2009 (Government of Antigua and Barbuda, 2004). This was developed to ensure that the country's private and public sectors remained focused in committing to a sustainable development approach. The Environmental Protection and Management Act (2015) was also established to provide sustainable environmental protection and management through various activities, and through the incorporation of international treaty obligations with respect to the environment.

Antigua and Barbuda has partnered with different local, regional and international organisations to help facilitate various projects in order to control these issues. These include: The United Nations Development Programme (UNDP), UNEP, Organisation of American States (OAS), European Union (EU), CARICOM, OECS, among others.

The nation is a Party to various Multilateral Environmental Agreements (MEAs) that are listed in Table 2.

Table 2: Multilateral environmental agreements to which Antigua and Barbuda is a Party

Treaty	Signature	Ratification
Cartagena Convention		11/11/1986
Basel Convention		5/04/1993
Cartagena Protocol		10/09/2003
Convention on Biological Diversity	5/06/1992	9/03/1993
Convention on International Trade of Endangered Species of Wild Fauna and Flora	8/07/1997	6/10/1997
Convention of Migratory Species	1/10/2007	1/10/2007
Kyoto Protocol	16/031998	3/11/1998
Minamata Convention on Mercury		23/23/2016
Montreal Protocol		3/12/1992
Nagoya Protocol	28/07/2011	12/12/2016
Nagoya Kuala Lumpur Supplementary Protocol	9/08/2011	
Paris Agreement	22/04/2016	21/09/2016
Ramsar Convention	2/10/2005	2/06/2005
Rotterdam Convention		23/08/10
Stockholm Convention	23/05/ 2001	10/07/03
United Nations Convention to Combat Desertification	4/04/1995	6/06/1997
United Nations Framework Convention on Climate Change	4/021992	2/2/1993
United Nations Convention on the law of the Sea	7/02/1983	2/02/1989
Vienna Convention		3/12/1992

Chapter 2: Mercury Inventory and Identification of Emissions and Releases

2.1 Summary of Mercury Releases, Stockpiles, and Supply and Trade

2.1.1 Mercury Release Source Types Present

Mercury released into the environment can come from a variety of sources. For the Toolkit, focus was placed on anthropogenic sources of mercury. In Antigua and Barbuda, the presence of these sources was identified through consultations with national stakeholders from public and private sectors (Table 3). Stakeholders were engaged through questionnaires, interviews and project workshops. The categories identified as not being present will not be discussed further in the report.

Table 3: Identification of mercury release sources in Antigua and Barbuda; sources present (Y), absent (N), and possible but not positively identified (?)

Toolkit Category Number.	Source category	Source presence (Y/N/?)
5.1	**Extraction and use of fuels/energy sources**	
5.1.1	Coal combustion in large power plants	**N**
5.1.2	Other coal combustion	**N**
5.1.3	Extraction, refining and use of mineral oil	**Y**
5.1.4	Extraction, refining and use of natural gas	**N**
5.1.5	Extraction and use of other fossil fuels	**N**
5.1.6	Biomass fired power and heat production	**N**
5.1.7	Geothermal power production	**N**
5.2	**Primary (virgin) metal production**	
5.2.1	Primary extraction and processing of mercury	**N**
5.2.2	Gold and silver extraction with the mercury-amalgamation process	**N**
5.2.3	Zinc extraction and initial processing	**N**
5.2.4	Copper extraction and initial processing	**N**
5.2.5	Lead extraction and initial processing	**N**
5.2.6	Gold extraction and initial processing by other processes than mercury amalgamation	**N**
5.2.7	Aluminium extraction and initial processing	**N**
5.2.8	Extraction and processing of other non-ferrous metals	**N**
5.2.9	Primary ferrous metal production	**N**
5.3	**Production of other minerals and materials with mercury impurities**	
5.3.1	Cement production	**N**
5.3.2	Pulp and paper production	**N**
5.3.3	Lime production and light weight aggregate kilns	**N**
5.3.4	Other minerals and materials	**N**

Toolkit Category Number.	Source category	Source presence (Y/N/?)
5.4	**Intentional use of mercury as an auxiliary material in industrial processes**	
5.4.1	Chlor-alkali production with mercury-technology	**N**
5.4.2	VCM (vinyl-chloride-monomer) production with mercury-dichloride ($HgCl_2$) as catalyst	**N**
5.4.3	Acetaldehyde production with mercury-sulphate ($HgSO_4$) as catalyst	**N**
5.4.4	Other production of chemicals and polymers with mercury compounds as catalysts	**N**
5.5	**Consumer products with intentional use of mercury**	
5.5.1	Thermometers with mercury	**Y**
5.5.2	Electrical and electronic switches, contacts and relays with mercury	**Y**
5.5.3	Light sources with mercury	**Y**
5.5.4	Batteries containing mercury	**Y**
5.5.5	Polyurethane with mercury catalysts	**N**
5.5.6	Biocides and pesticides	**N**
5.5.7	Paints	**N**
5.5.8	Pharmaceuticals for human and veterinary uses	**N**
5.5.8	Cosmetics and related products	**Y**
5.6	**Other intentional products/process uses**	
5.6.1	Dental mercury-amalgam fillings	**Y**
5.6.2	Manometers and gauges	**Y**
5.6.3	Laboratory chemicals and equipment	**Y**
5.6.4	Mercury metal use in religious rituals and folklore medicine	**N**
5.6.5	Miscellaneous product uses, mercury metal uses and other sources	**N**
5.7	**Production of recycled metals**	
5.7.1	Production of recycled mercury ("secondary production)	**N**
5.7.2	Production of recycled ferrous metals (iron and steel)	**N**
5.7.3	Production of other recycled metals	**N**
5.8	**Waste incineration**	
5.8.1	Incineration of municipal/ general waste	**N**
5.8.2	Incineration of hazardous waste	**N**
5.8.3	Incineration of medical waste	**Y**
5.8.4	Sewage sludge incineration	**N**
5.8.5	Informal waste burning	**Y**
5.9	**Waste deposition/landfilling and wastewater treatment**	
5.9.1	Controlled landfills/deposits	**Y**
5.9.2	Diffuse deposition under some control	**N**

Toolkit Category Number.	Source category	Source presence (Y/N/?)
5.9.3	Informal local deposition of industrial production waste	**N**
5.9.4	Informal dumping of general waste	**Y**
5.9.5	Wastewater system/treatment[2]	**N**
5.10	**Cremation and cemeteries**	
5.10.1	Crematoria	**N**
5.10.2	Cemeteries	**Y**

2.1.2 Summary of Estimated Mercury Inputs to Society

Mercury inputs to society should be understood here as the mercury made available for potential releases through economic activity in Antigua and Barbuda. This includes mercury intentionally used in products such as thermometers, blood pressure gauges and fluorescent light bulbs as well as mercury that can become available through the disposal of these products. It also includes mercury mobilised via extraction and use of raw materials, which contains mercury in trace concentrations.

Mercury inputs to Antigua and Barbuda for the source categories identified as being present in Table 3 are shown below in Table 4.

Table 4: Summary of mercury inputs to Antigua and Barbuda

Source category	Estimated Hg Input (Kg Hg/y)
Extraction and use of fuels/energy sources	
Extraction, refining and use of mineral oil	**1.78**
Consumer products with intentional use of mercury	
Thermometers with mercury	**1.86**
Electrical and electronic switches, contacts and relays with mercury	**10.77**
Light sources with mercury	**0.04**
Batteries containing mercury	**0.23**
Cosmetics and related products	*Data not available*
Other intentional products/process uses	
Dental mercury-amalgam fillings	**3.91**
Manometers and gauges	**2.25**
Laboratory chemicals and equipment	**4.91**
Waste incineration	

[2] The Caribbean Water Treatment Ltd. has strategised plans to build an efficient, environmentally sound water treatment facility in Antigua and Barbuda (IWCAM, 2010). However, the expected date of implementation has not been determined. There are a few hotels on the island that have sewage treatment facilities for private use, but the amount of wastewater from these hotels is not known.

Source category	Estimated Hg Input (Kg Hg/y)
Incineration of medical waste	**0.19**
Informal waste burning	**12.00**
Waste deposition/landfilling and wastewater treatment	
Controlled landfills/deposits	**4.87**
Informal dumping of general waste	*Data not available*
Cremation and cemeteries	
Cemeteries	**0.49**

The sum of mercury inputs to Antigua and Barbuda for 2016 was determined to be approximately 27.95 Kg Hg. This input was calculated using national data collected through stakeholder engagement and default input factors present in the Toolkit. The total input includes only 10% of the calculated mercury input from waste incineration sources, waste deposition and informal dumping to avoid double counting of mercury inputs from waste and products. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit.

Mercury in waste and wastewater produced in Antigua and Barbuda originates in products and materials in which mercury was intentionally used. Imported wastes may represent original mercury inputs to a country, however, this is not relevant as Antigua and Barbuda does not import wastes from other countries. Waste deposition to controlled landfills and wastewater may, however, represent substantial flows of mercury through society.

The following source sub-categories (waste sub-categories not included) made the largest contributions to mercury inputs to Antigua and Barbuda:

- Electrical switches and relays (10.77 Kg Hg/y);
- Laboratory chemicals and equipment (4.91 Kg Hg/y); and
- Dental amalgam fillings (3.91 Kg Hg/y).

Overall, the largest source of mercury input to Antigua and Barbuda is from consumer products with intentional use of mercury with 12.90 Kg Hg released per year.

2.1.3 Summary of Mercury Releases

Key mercury releases are to air (the atmosphere), water (marine and freshwater bodies, including via wastewater systems), land, general waste, and sector specific waste treatment/disposal. An additional output pathway is "by-products and impurities" which designates mercury flows back into the market in by-products and products where mercury does not play an intentional role. Table 5 describes these output pathways.

Table 5: Descriptions of the types of output pathways for mercury releases

Calculation Result Type	Description
Estimated Hg input, Kg Hg/y	The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury amount in coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example, from: • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources such as small-scale gold mining, informal burning of waste with fluorescent lamps, batteries, thermometers.
Water	Mercury releases to aquatic environments and to wastewater systems; point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example, releases from: • Wet flue gas cleaning systems on coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps.
Land	Mercury releases to the terrestrial environment: General soil and ground water. For example, releases from: • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction; • Uncollected waste products dumped or buried informally; • Local un-confined releases from industry such as on-site hazardous waste storage/burial; • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertiliser); • Application on land, seeds or seedlings of pesticides with mercury compounds.
By-products and impurities	By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, for example: • Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants; • Sulphuric acid produced from desulphurisation of flue gas (flue gas cleaning) in non-ferrous metal plants with mercury trace concentrations; • Chlorine and sodium hydroxide produced with mercury-based chlor-alkali technology; with mercury trace concentrations; • Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations).

Calculation Result Type	Description
General waste	General waste: Also called municipal waste in some countries. Typically, household and institution waste where the waste undergoes a general treatment, such as incineration, landfilling or informal dumping. The mercury sources to waste are consumer products with intentional mercury content (batteries, thermometers, fluorescent tubes, etc.) as well as high volume waste like printed paper, plastic, etc., with small trace concentrations of mercury.
Sector specific waste treatment /disposal	Waste from industry and consumers which is collected and treated in separate systems, and in some cases recycled; for example: • Confined deposition of solid residues from flue gas cleaning on coal fired power plants on dedicated sites; • Hazardous industrial waste with high mercury content, which is deposited in dedicated, safe sites; • Hazardous consumer waste with mercury content, mainly separately collected and safely treated batteries, thermometers, mercury switches, lost teeth with amalgam fillings, etc.; • Confined deposition of tailings and high-volume rock/waste from extraction of non-ferrous metals.

Table 6 summarises mercury releases to the various output pathways in Antigua and Barbuda based on Toolkit calculations using 2016 data and default values where data was not available. Details on how the release values were obtained are included in the respective subsections of this report. Source categories that were not identified as being present in Antigua and Barbuda are not included in the table.

Table 6: Summary of mercury releases in Antigua and Barbuda for 2016

Source category	Estimated Hg Input (Kg Hg/y)					
	Air	Water	Land	By-products and impurities	General waste	Sector-specific treatment / disposal
Extraction and use of fuels/energy sources						
Extraction, refining and use of mineral oil	**1.78**	**0**	**0**	**0**	**0**	**0**
Consumer products with intentional use of mercury						
Thermometers with mercury	**0.19**	**0.56**	**0**	**-**	**1.12**	**0**
Electrical and electronic switches, contacts and relays with mercury	**1.08**	**0**	**1.08**	**0**	**8.62**	**0**
Light sources with mercury	**0**	**0**	**0**	**-**	**0.04**	**0**
Batteries containing mercury	**0**	**0**	**0**	**-**	**0.23**	**0**
Cosmetics and related products	**0**	**0**	**0**	**-**	**0**	**0**
Other intentional products/process uses						
Dental mercury-amalgam fillings	**0.09**	**1.69**	**0.28**	**0.21**	**0.83**	**0.83**
Manometers and gauges	**0.23**	**0.68**	**0**	**0**	**1.35**	**0**
Laboratory chemicals and equipment	**0**	**1.62**	**0**	**0**	**1.62**	**1.67**
Waste incineration						
Incineration of medical waste	**0.19**	**0**	**0**	**0**	**0**	**0**
Informal waste burning	**12.00**	**0**	**0**	**0**	**0**	**0**
Waste deposition/landfilling and wastewater treatment						
Controlled landfills/deposits[3] [4]	**4.82**	**0.05**	**0**	**0**	**0**	**0**
Informal dumping of general waste	**0.00**	**0.00**	**0.00**	**-**	**-**	**-**
Cremation and cemeteries						
Cemeteries	**0**	**0**	**0.49**	**-**	**0**	**0**
Sum of Quantified Inputs and Releases	**20.38**	**4.59**	**1.84**	**0.21**	**14.00**	**2.50**

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

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

2.2 Data and Inventory on Extraction and Use of Fuels/ Energy Sources

2.2.1 Use of Mineral Oils

Mineral oils or petroleum oils are combusted to provide heat and power and for transportation. Mineral oils also have other uses such as the synthesis of chemicals, lubricants, polymers and black pigments. Small amounts of mercury are contained within petroleum oils as impurities. These can be emitted into the atmosphere through extraction, refining and use (UNEP, 2019a). In refineries, crude oil can be separated via distillation into various fractions such as gasoline/petrol, kerosene, jet fuel, liquefied petroleum gas and other distillates.

The West Indies Oil Company (WIOC) was an oil refinery in Antigua and Barbuda during the mid-1900's but stopped refining operations in 1982 (WIOC, 2018). No other historic or present extraction and refining activities were identified in Antigua and Barbuda. WIOC now serves as a storage-terminal in Antigua for various commercial fuels such as sulfur diesel, gasoline, heavy fuel oil and other light to medium distillates imported from Venezuela. Fuels are transported to various service stations and commercial and industrial businesses where they are utilised. The distillates may contain small amounts of mercury impurities which can be released to air upon volatilisation.

Antigua Public Utilities Authority (APUA) supplies electricity to Antigua and Barbuda. 80-90% of the electricity supply in Antigua is generated by the Antigua Power Company using heavy fuel oil, and the remainder is generated by APUA. APUA also produces electricity in Barbuda using a diesel-powered plant (IRENA, 2016).

Liquid Petroleum Gas (LPG) is imported and used for heating and cooking, while diesel and gasoline are primarily used for transportation purposes.

Data Collection and Assessment

Data for mineral oils imported into Antigua and Barbuda in 2016 was obtained from the Customs Department (Table 7). The provided quantities were listed in UK gallons and were converted to tonnes using average conversion factors for petroleum and refined products compiled by the UK Petroleum Industry Association for 2001.

Table 7: 2016 Customs data and conversion factors for imported mineral oils

HS Codes \ Indicators	Supplementary Quantity (UK gallons)	Supplementary Quantity (tonnes)	Conversion Factor (UK gallons/ tonne)	Category used to determine Conversion Factor
2710.11.30 \ Motor Spirit (Gasoline)	9,128,191	30,529.07	299	Motor Spirit: All Grades
2710.19.50 \ Gas Oils/Diesel	5,245,720	20,411.36	257	Gas/Diesel Oil: Gas Oil
2710.11.10 \ Jet Fuel	10,244,561	37,252.95	275	Kerosene: Aviation Turbine Fuel

HS Codes \ Indicators	Supplementary Quantity (UK gallons)	Supplementary Quantity (tonnes)	Conversion Factor (UK gallons/ tonne)	Category used to determine Conversion Factor
2710.19.60 \ Bunker "C" Grade Fuel Oil	15,611,548	70,322.29	222	Fuel Oil: Heavy Fuel Oil with > 1% Sulphur
2710.19.83 \ Lubricating Oils	216,835	870.82	249	Lubricating Oils: Other
TOTAL	**40,446,855**	**159,386.49**		

The imported Bunker "C" Grade Fuel Oil is heavy fuel oil used to produce electricity. The default input factor of 20 mg Hg/tonne was used to calculate the mercury input from the sub-category "Use of heavy oil and petroleum coke". The other oil types have a total net mass of 89,064.20 tonnes and are used for transportation purposes and other uses. There is no available local data for the estimated mercury content of the different types of mineral oils used in Antigua and Barbuda; however, the Toolkit Reference Report indicates that crude oil from Venezuela has an average mercury concentration of 4.2 mg Hg/tonne (UNEP, 2019a). This value was used as the input factor to calculate the approximate input of mercury from the use of light to medium distillates.

The estimated mercury input to Antigua and Barbuda from the use of mineral oils was determined to be 1.78 Kg Hg/y. No emission controls were identified as being present, so it is expected that the total input is released to air from this sub-category. Table 8 shows the input and output factors used to calculate the releases of mercury from the use of mineral oils in Antigua and Barbuda.

Table 8: Analysis of mercury inputs and outputs from the use of mineral oils

Use of Mineral Oils	Unit	Use of heavy oil and petroleum coke	Use of gasoline, diesel, light fuel oil, kerosene, LPG and other light to medium distillates
Activity rate	Oil, t/y	70,322.29	89,064.20
Input factor for phase	mg Hg/t oil	20	4.2
Calculated input to phase	Kg Hg/y	1.41	0.37
Output distribution factors for phase:			
- Air	N/A	1	1
- Water	-	-	-
- Land	-	-	-
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-
Calculated outputs/releases to:			
- Air	Kg Hg/y	1.41	0.37
- Water	-	-	-
- Land	-	-	-
- Products	-	-	-
- General waste treatment	-	-	-

Use of Mineral Oils	Unit	Use of heavy oil and petroleum coke	Use of gasoline, diesel, light fuel oil, kerosene, LPG and other light to medium distillates
- Sector specific waste treatment	-	-	-

Data Gaps and Priorities for Potential Follow-Up

Local data on the mercury content of imported and used mineral oils should be sourced. Additionally, further study is needed on the output distribution factors for the use of various distillates of mineral oils to determine whether mercury is released to other pathways.

2.3 Data and Inventory on Consumer Products with Intentional Use of Mercury

Several products make use of mercury's properties to support their functions. The major product groups in which mercury is added intentionally are thermometers, fluorescent light bulbs, some batteries, older types of electrical switches and relays, and some manometers and pressure gauges.

Releases take place during production, depending on how closed the manufacturing systems are, and on the handling and workplace procedures in the individual production units; during use, when products are broken or damaged; during disposal of the products after use (directly to soil through landfills and informal dumping sites, to the air via waste incineration and informal burning, and to water through wastewater treatment, landfill leachate and runoff) according to the types and efficiency of waste collection and handling procedures implemented (UNEP, 2019a).

Under Article 4 of the Minamata Convention on Mercury, Parties must phase out the manufacture, import and export of certain mercury-added products listed under Annex A by the year 2020.

In Antigua and Barbuda, no production of products containing mercury occurs. However, items are imported, used and disposed of locally.

2.3.1 Thermometers with Mercury

Thermometers (medical, ambient air, industrial and special, other glass thermometers) are instruments used to measure the temperature of a system. Mercury is used in thermometers due to its various properties such as a high boiling point and high coefficient of expansion (UNEP, 2019). As the temperature changes, the mercury expands or contracts within the tube, and the temperature can be recorded manually or automatically using a standardised scale on a thermometer. Mercury thermometers are used in various fields such as the medical, education and industrial sectors. Various alternatives are available such as mercury-free liquid-in glass thermometers, dial thermometers, electronic thermometers and infrared thermometers (COWI and Concord East/West, 2008).

Since the mercury in thermometers is contained within a sealed containment, it does not pose any risk during use. However, once broken or cracked, the mercury contained within can be emitted to the air as vapours or released to the land and to water (UNEP, 2019a).

Mercury containing medical, ambient air, industrial and special and other glass thermometers are used in various sectors throughout Antigua and Barbuda. However, due to the health risk associated with exposure to mercury from broken thermometers, mercury thermometers have been and/or are being phased out. For example, the main hospital, Mount St. John's Medical Center (MSJMC), and other public and private clinics have replaced mercury thermometers with digital thermometers. The West Indies Oil Company, which has also used mercury-added thermometers in the past, has also begun phasing out the use of these items. Other users such as schools and laboratories still use mercury thermometers for testing, lab exercises and teaching. Further, mercury thermometers have been used in households in the past, and it is possible that they are still in use.

Most broken thermometers from households are collected by National Solid Waste Management Authority (NSWMA) and are delivered to the Cooks Landfill in Antigua or the Plantation Landfill in Barbuda, where they are buried with other wastes. Once buried, the mercury can be released into the ground or collected as leachate. Also, the Department of Analytical Services has undertaken to stockpile thermometers collected from various sources in an effort to facilitate subsequent disposal. It is recognised that if stockpiled broken thermometers are not properly stored, mercury vapours can be emitted into the atmosphere.

Data Collection and Assessment

Customs data did not highlight the number of thermometers imported into Antigua and Barbuda in 2016. As such, questionnaires and interviews with other relevant stakeholders were the primary data collection tools employed to gain information for this sub-category.

Information received from Antigua and Barbuda's Central Medical Procurement Unit showed that 600 medical thermometers were distributed to the MSJMC between 2017 and 2018 while 1,114 remained in their inventory. It was assumed that these items were imported in 2016 and this was included in the activity rate for this sub-category.

Information was also received from the Ministry of Education that showed that 150 mercury thermometers were imported by the Ministry during the last 10 years. It was assumed that all thermometers were still in use during 2016 due to the life span of these objects.

The total of 1,864 medical thermometers was used to estimate the input of mercury from the use and disposal of thermometers in 2016. This may not be a full representation of all the items imported in Antigua and Barbuda for the year as it does not account for thermometers imported by distributors and retailers for sale to households, businesses and other entities. The quantities of ambient air, industrial and special, and other glass mercury thermometers imported and used in Antigua and Barbuda could not be determined.

There is no local data for the quantities of mercury contained in these medical thermometers, and therefore, the default mercury input factor from the Toolkit was used to calculate the estimated mercury input to society, 1.86 Kg Hg/y. There is no separate collection of thermometers with mercury, but waste handling is controlled. Some thermometers used in MSJMC may be incinerated with other biomedical wastes at the hospital, however, as the quantity of thermometers was not confirmed, it was assumed that all were disposed of at the Cooks Landfill.

The summary of input and output factors used to estimate the inputs and releases of mercury from the use and disposal of medical thermometers is shown in Table 9.

Table 9: Analysis of mercury inputs and outputs from the use and disposal of thermometers with mercury

Thermometers with Mercury	Unit	Use and Disposal of Medical Thermometers
Activity rate	Items/yg	1,864
Input factor for phase	Hg/item	1
Calculated input to phase	Kg Hg/y	1.86
Output distribution factors for phase:		
- Air	N/A	0.1
- Water	N/A	0.3
- Land	-	-
- Products	-	-
- General waste treatment	N/A	0.6
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	Kg Hg/y	0.19
- Water	Kg Hg/y	0.56
- Land	-	-
- Products	-	-
- General waste treatment	Kg Hg/y	1.12
- Sector specific waste treatment	-	-

<u>Data Gaps and Priorities for Potential Follow-Up</u>

The data corresponding to the number of mercury thermometers (medical, ambient air, industrial and other Hg thermometers) imported in 2016 was not obtained from the Antigua and Barbuda Statistics Division. As such, information is needed on the quantities of thermometers, by type, imported and used in Antigua and Barbuda. Further, local data on the mercury content in each item should be sourced.

Although many institutions have begun to phase out mercury thermometers, there remains the issue of the disposal of remaining and spent thermometers in an environmentally sound manner. Thermometers containing mercury could be stored in properly lined drums temporarily until further disposal

procedures can be administered; that is, shipment to a facility that would dispose of it correctly (UNEP, 2019a). Data on the quantities of thermometers disposed of should be obtained along with additional details on the amount of mercury released to each output pathway. This would assist in more accurately identifying local output distribution factors of mercury releases from this source.

2.3.2 Electrical Switches and Relays with Mercury

Mercury is used in some electrical switches and relays found in various electronic equipment due to its high density, conductivity and sensitivity to temperature (Franklin County Solid Waste Management District, 2001). The elemental mercury within electrical switches and relays expands or contracts in order to open or close a valve. It can also be used to make electrical connections within switches during their operation (UNEP, 2019a).

The most common use of elemental mercury is in tilt switches or “silent” switches which are used in numerous products including silent electric wall switches, electric switches for thermostats used in residential and commercial heating, antilock braking systems and active ride-control systems in vehicles and convenience lights (such as those used in car trunks when opened). Another type of switch is the “float” switch which is used in pumps to activate or deactivate equipment (UNEP, 2019a).

Relays, electrically controlled switches, are used in high current lighting and heating (displacement relays), small circuit controls for low voltage electronic devices primarily used in test, calibration and measurement equipment (wetted read relays). Although mercury relays may be widely used, their total mercury consumption has been relatively small compared to the mercury switches (UNEP, 2019a).

Globally, mercury-free switches and relays have become more popular over the past twenty (20) years, but the status and extent of substitution varies between countries (UNEP, 2019a). Further, due to the long service life of mercury switches and relays (ranging from 10-50 years, primarily based on the life span of the equipment in which the switch or relay is contained), mercury from these items are expected to be present in wastes for many years despite the use of alternative products.

Mercury contained in electrical switches and relays does not pose a risk to human health and the environment when the items are intact as a tight seal prevents the release of mercury. However, mercury becomes a hazard when the products are damaged and the seal is broken thus allowing elemental mercury to be emitted into the atmosphere as vapours, or into waterways or the land.

In Antigua and Barbuda, electrical switches and relays are not produced locally but are imported as components of larger electronic equipment. Although imported switches and relays may not contain mercury due to the increased global popularity of mercury free options, mercury containing items may be included in older equipment and homes. With regard to disposal, the products containing switches and relays are delivered to the Cooks Sanitary Landfill in Antigua or to the Plantation Landfill in Barbuda. Upon arrival, the switches and relays are not removed before the appliances are stockpiled, crushed or buried. When crushed within the landfill, the protective casing wherein mercury is contained may be torn and ripped, causing elemental mercury to be emitted into the atmosphere through vaporisation. The mercury can also leach into the ground and be collected as leachate.

Data Collection and Assessment

Specific data on the number of electrical switches and relays in use and disposed of in 2016 in Antigua and Barbuda and their mercury content was not available as these items are included as components of larger equipment and are typically not quantified. Therefore, default Toolkit calculations were used to estimate mercury input to society and output from this category. The calculations utilised the number of inhabitants and the percent electrification rate from 2001 to give a more accurate estimation of the historical consumption and the 2016 disposal rates. These values were 85,057 residents and 90.476%, respectively (World Bank Data Group, 2019).

According to the Toolkit, approximately 10.77 Kg Hg/y is input to Antigua and Barbuda from the use and disposal of electrical switches and relays. There is no separate collection of these items and waste handling is controlled. As such, it was estimated that 1.08 Kg Hg/y is released each to air and to the land, while the majority of the estimated mercury (8.62 Kg Hg/y) is released to general waste. The summary of estimated releases of mercury in electrical switches and relays is shown in Table 10.

Table 10: Analysis of mercury inputs and outputs from the use and disposal of electrical switches and relays with mercury

Electrical Switches and Relays with Mercury	Unit	Use and Disposal
Activity rate	inhabitants	85,057
	% of population with access to electricity	90.476
Input factor for phase	g Hg/(y*inhabitant)	0.14
Calculated input to phase	Kg Hg/y	10.77
Output distribution factors for phase:		
- Air	N/A	0.1
- Water	-	-
- Land	N/A	0.1
- Products	-	-
- General waste treatment	N/A	0.8
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	Kg Hg/y	1.08
- Water	-	-
- Land	Kg Hg/y	1.08
- Products	-	-
- General waste treatment	Kg Hg/y	8.62
- Sector specific waste treatment	-	-

Data Gaps and Priorities for Potential Follow-Up

Quantifying the amount of mercury input from this sub-category can be facilitated by the removal of electrical switches and relays from equipment and electronics before their disposal at the landfill. The number of removed switches and relays can be recorded along with the presence of mercury and the amount of mercury used. The first course of action would be to make the general public aware of the risks associated with mercury contained in these

products to encourage their participation in an implemented collection system. Switches and relays that are removed could be dispatched to recycling companies where the mercury would be recovered, and the remaining parts of the items could be recycled.

2.3.3 Light Sources with Mercury

Small amounts of mercury are used in various discharge lamps including linear fluorescent tubes (LFLs), compact fluorescent lamps (CFLs), mercury vapour lamps, high-pressure sodium lamps and metal halide lamps. CFLs and LFLs are typically used for general lighting in residences and buildings, while high-pressure sodium lamps and metal halide lamps can be used in streetlights and lights utilised in stadiums. The amount of mercury contained in these light sources vary and depend on the type of bulb.

Mercury is not considered a threat to the environment when it is contained within the glass tube of the bulbs. When the bulbs and lamps are broken, however, vapour-phase elemental mercury, liquid mercury and mercury absorbed onto phosphor powder which coats the inside surface of the tube can be released into the environment. Small amounts of mercury could also be released from pieces of the glass and other components of the lamps that are contaminated with the mercury (UNEP, 2019a).

Lighting products containing mercury are not produced in Antigua and Barbuda, however, they are imported from countries such as China, Hungary, Italy, the United Kingdom and the United States.

Most of Antigua and Barbuda's streetlights include high-pressure sodium lamps and mercury vapour lamps, which consume a lot of energy. To conserve energy and also to reduce the potential health risks associated with the release of mercury from broken lamps, the Government of Antigua and Barbuda, in collaboration with the Central Development Bank (CDB), launched a streetlight retrofitting project to replace approximately 14,000 high-pressure sodium lamps and mercury vapour lamps with LED lights (CDB, 2017). According to discussions held with the APUA in 2019, about 7,000 lights have been replaced so far, and some are being stored by APUA while others are being sold to a private waste company with a bulb crusher.

The function of a bulb crusher is to reduce the volume of the lamp waste and to separate mercury vapour from the other bulb components. Bulb crushers are equipped with filters that can capture mercury vapours which can then be recovered, recycled or disposed of in an environmentally sound manner. The other components may still be contaminated with mercury and additional processing is required before they can be buried in a landfill or recycled. APUA has two (2) bulb crushers, and NSWMA has an 'Aircycle Bulb Eater' at the Cooks Sanitary Landfill. The NSWMA equipment had been previously used to fill one (1) drum with crushed fluorescent tubes. However, it was noted that the agency has not been able to source suitable drums for containment of the crushed bulbs and, as of 2019, operations were paused. As such, the few intact bulbs which are brought directly to the Cooks Sanitary Landfill were stockpiled at the site.

Most bulbs from households and businesses are delivered to the Cooks Sanitary Landfill in Antigua or the Plantation Landfill in Barbuda where they are buried. Bulbs are generally broken during transportation or during the landfill burial process.

Data Collection and Assessment

Import data for the import of "Discharge Lamps: Mercury or Sodium Vapour Lamps; Metal Halide Lamps" (820 items) and "Other" (4,508 items) in 2016 was obtained from the Customs Department. Specific types of bulbs were not identified in the data provided. For the purpose of the inventory calculations, it was assumed that the light sources identified as "Discharge Lamps: Mercury or Sodium Vapour Lamps; Metal Halide Lamps" were equally mercury and sodium vapour lamps which are used in streetlights throughout the island. Items described as "Other" were assumed to be CFLs which are more commonly used than LFLs. Quantities of imported lights containing mercury may vary by year.

There is no local data on the mercury content within the various light sources used. Therefore, the default mercury input factor derived from the Toolkit was used to calculate an estimated input of 0.04 Kg Hg/y. There is no separate collection of spent mercury added bulbs, but there is some level of control with regards to waste handling. The summary of estimated releases is shown in Table 11.

Table 11: Analysis of mercury inputs and outputs from the use and disposal of light sources with mercury

Light Sources with Mercury	Unit	Use and Disposal		
		Compact Fluorescent Lamps	High-Pressure Mercury Vapour	High-Pressure Sodium Lamps
Activity rate	Items/y	4,508	410	410
Input factor for phase	mg Hg/item	2.7	40	20
Calculated input to phase	Kg Hg/y	0.01	0.02	0.01
Output distribution factors for phase:				
- Air	N/A		0.05	
- Water	-		-	
- Land	-		-	
- Products	-		-	
- General waste treatment	N/A		0.95	
- Sector specific waste treatment	-		-	
Calculated outputs/releases to:				
- Air	Kg Hg/y		0.00	
- Water	-		-	
- Land	-		-	
- Products	-		-	
- General waste treatment	Kg Hg/y		0.04	
- Sector specific waste treatment	-		-	

Data Gaps and Priorities for Potential Follow-Up

The types of bulbs imported were not specified in the data received from the Customs Department. As such, assumptions were made regarding the distribution of the quantities of each type of bulb imported, and the data input into the spreadsheet may not reflect the actual national situation. As a result, the estimated mercury input may be an over- or under-estimation. Specific information on the quantity of each bulb type should be

sourced and input into the spreadsheet for more accurate results.

Historic data on the use and disposal of light sources with mercury in Antigua and Barbuda should be obtained in order to determine whether this source may have resulted in more significant mercury releases and emissions in the past.

2.3.4 Batteries with Mercury

Batteries are among the largest product uses of mercury (UNEP, 2019a). Primary, non-rechargeable batteries which contain mercury include mercury oxide batteries, some cylindrical alkaline batteries, and some button cell batteries (alkaline, zinc/air, silver oxide) which are used to provide power in small portable electronics such as calculators and wrist watches. High concentrations of mercury (30-32% w/w) have been used in the positive electrode in button cells, larger cylindrical and other shaped mercury oxide batteries used in hospitals, military facilities and commercial appliances (Zero Mercury Working Group, n.d.). About 0.25 mg of mercury are added to the zinc-air, alkaline and silver-oxide batteries to prevent the formation of internal gases (Zero Mercury Working Group, n.d.).

The use of mercury in batteries does not pose a threat to human health or the environment once the batteries are intact. Mercury only becomes a hazard when the batteries are broken allowing elemental mercury to be released into the atmosphere as vapours, and into land and general waste. Due to the risks associated with the exposure of mercury from batteries, some countries have prohibited the marketing of mercury oxide batteries and other batteries with mercury for purposes other than specified exemptions such as military uses (UNEP, 2019a).

In Antigua and Barbuda, batteries containing mercury are not produced, but are imported as products and as components of electronics and other products. Individual batteries are imported from countries including China, Japan, Panama, Italy and the United States.

Spent batteries containing mercury and end of life equipment containing batteries with mercury are delivered to the Cooks Landfill in Antigua or the Plantation Landfill in Barbuda with other municipal wastes. Batteries and other hazardous components are not removed from the discarded items they were contained in before burial. When the spent products are crushed, the protective casing from the batteries can be broken, allowing elemental mercury to be released into the atmosphere upon vapourisation. Mercury can also contaminate the ground and be collected as leachate.

Data Collection and Assessment

The quantities of batteries, by type, imported into Antigua and Barbuda in 2016 were obtained from the Customs Department. The information provided for manganese dioxide batteries did not include specifications on the quantities of imports by shape, so it was assumed that all could be categorised as alkaline, other than button cell shapes. The total weights of the identified product imports were not provided. As such, individual battery weights were sourced online and used to calculate the activity rate for this sub-category based on the assumption that the batteries imported had the same weights as the batteries sold in the online stores.

No value for the weight of mercury oxide batteries was obtained. However, since Customs data recorded that only 2 of these batteries were imported in 2016, it was assumed that negligible mercury input to society would be released from this category.

Table 12 summarises the quantities of imports, the weight per item based on online information and the approximate total weight of imports of each type of battery.

Table 12: Quantities and estimated weights of batteries imported into Antigua and Barbuda in 2016

Battery Type	Weight/ battery (g)	Number of Batteries Imported	Weight of Batteries Imported (t/y)
Mercury Oxide	No value obtained	2	No value obtained
Zinc-air button cell[5]	0.58	12	6.96×10^{-6}
Alkaline, other than button cell shapes (Manganese Dioxide)[6]	11	82,058	0.903
Silver oxide button cells[7]	0.61	4	2.44×10^{-6}

[5]Weight of a Zinc-Air Mercury Free Button Cell Battery used to approximate the weight of a mercury containing zinc-air battery (https://cpc.farnell.com/varta/4607210416/battery-zinc-air-p312-pk6/dp/BT05102?st=zinc-air%20battery)
[6]Weight of a Lithium (CR2)/ Manganese Dioxide Battery used to approximate the weight of an alkaline, other than button cell battery (http://www.farnell.com/datasheets/1782915.pdf)
[7]Weight of a Mercury-Free Silver Oxide Button Cell used to approximate the weight of a mercury containing silver oxide button cell (http://www.farnell.com/datasheets/856371.pdf)

The number of batteries with mercury entering the country in 2016 as components of larger products and equipment could not be determined for the inventory.

There is no local data for the mercury content in the various types of batteries. Thus, it was assumed that all identified batteries contained mercury, and the default input factors in the Toolkit were used to determine mercury input into society. The input factors vary based on the type of battery.

Based on the calculated activity rates, mercury oxide, zinc-air and silver oxide batteries contributed negligible mercury input to Antigua and Barbuda. The mercury input for manganese dioxide (alkaline) batteries was estimated to be 0.23 Kg Hg/y. Outputs are primarily to general waste treatment as there is no separate collection of batteries and waste handling is somewhat controlled. Table 13 summarises the estimated releases of mercury from the use and disposal of batteries.

Table 13: Analysis of mercury inputs and outputs from the use and disposal of batteries with mercury

Batteries with Mercury	Unit	Use and Disposal of Alkaline, Other than Button Cell Shapes
Activity rate	Batteries, t/y	0.903
Input factor for phase	Kg Hg/t batteries	0.25
Calculated input to phase	Kg Hg/y	0.23
Output distribution factors for phase:		
- Air	N/A	-
- Water	-	-
- Land	N/A	-
- Products	-	-
- General waste treatment	N/A	1.0
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	Kg Hg/y	-
- Water	-	-
- Land	Kg Hg/y	-
- Products	-	-
- General waste treatment	Kg Hg/y	0.23
- Sector specific waste treatment	-	-

Data Gaps and Priorities for Potential Follow-Up

The data obtained on the quantities of batteries imported in 2016 is limited as batteries included as components of larger products were not recorded. Imported products which may contain batteries upon entry into Antigua and Barbuda should be considered in future assessments in order to provide a better estimate of the numbers of batteries imported each year.

In order to calculate the mercury inputs and releases from the use and disposal of batteries with mercury, the weight of batteries imported during the reference year is required. Customs Officials in Antigua and Barbuda only record the number of batteries imported and not the weights. As the specific type of battery was also not included in the data sheet, it was difficult to determine the weight of each item through online data sheets. As such, individual weights of similar battery types were sourced online, and it was assumed that the weights of the imported batteries were equivalent to the weights of the items found online.

The presence of mercury in the imported batteries was also not noted by Customs. As such, it was assumed that all items contained mercury which may have resulted in an overestimation of mercury inputs since mercury added batteries are being restricted in global markets.

2.3.5 Cosmetics and Related Products with Mercury

Mercury is used in the production of some skin-lightening creams and soaps, and as a preservative in some eye make-up products including mascara (UNEP, 2019a). Inorganic mercury in skin lightening products inhibits the formation of melanin, thereby lightening the user's complexion (WHO, 2011). The mercury in these products can accumulate within the body where it can cause damage to the nervous system and have adverse effects

on the kidney and other organs (UNEP, 2019a).

When the products containing mercury are washed off, they can be released into wastewater systems and waterways. Mercury can then bioaccumulate in aquatic species which may be consumed by humans. When containers are discarded, small amounts of creams may remain and be a source of mercury release to the environment through general waste. In this regard, the manufacture, import and export of skin lightening products with mercury content greater than 1 ppm are to be phased out by Parties to the Minamata Convention on Mercury by 2020. Furthermore, some skin-lightening creams may contain other harmful melanin suppressors instead of mercury, such as hydroquinone.

The use of skin lightening creams has been found to be prevalent around the globe especially in African and Asian countries and Afro-diaspora regions like the Caribbean, where the trend of skin lightening has become prominent in beauty fads, culture and music (Hamann, et al., 2014; Copan et al., 2015).

Skin lightening creams and soaps are not produced in Antigua and Barbuda; however, products are imported from other countries for use locally, and some may contain mercury. While some skin-lightening products may be safe to use, many products on the global and local markets are unlabelled, mislabelled, counterfeit or labelled in a foreign language. Additionally, some products may list mercury-containing compounds by ambiguous names such as calomel or cinnabaris. Therefore, the risk of using any of these products is increased as consumers are not always able to identify mercury as a component (Zero Mercury Working Group, n.d.).

Most empty skin-lightening cream containers are discarded in domestic waste and sent to the Cooks Landfill in Antigua and to the Plantation Landfill in Barbuda. There, they are crushed and buried among general wastes within the landfills.

Data Collection and Assessment

Under the MIA Project, forty (40) different types of skin bleaching creams were purchased in the four (4) participating countries including Antigua and Barbuda. The creams were tested for their mercury content by Biodiversity Research Institute (BRI).

Sixteen (16) skin-lightening creams were purchased in Antigua for testing, and two (2) of the creams were found to exceed the 1 ppm limit specified by the Minamata Convention. The cream, ***Silken Deluxe***, was manufactured in Jamaica and was found to contain a significantly high concentration of 19,000 ppm of mercury. The second cream, ***Nadinola Vanishing Cream***, was manufactured in the Dominican Republic and contained a mercury concentration of 4 ppm. The production of these creams is informal and thus, concentrations may vary between batches of the same product. The ingredients displayed on the containers of both creams do not list any mercury containing compounds.

The amount of skin lightening creams and soaps containing mercury which were imported into Antigua and Barbuda in 2016 could not be determined for the inventory. As such, the estimated mercury inputs and releases from this source could not be quantified.

The data needed for the activity rate (amount of creams/soaps sold, t/y) was not available; therefore, estimates of mercury inputs and releases to the various pathways could not be calculated. Data on this category should be obtained through

further stakeholder communication. Additionally, the sale of Silken Deluxe and Nadinola Vanishing Cream in Antigua and Barbuda should be quantified along with quantities of other mercury-added creams available locally.

Due to the potential risk of mercury exposure from the use and disposal of skin-lightening creams containing mercury, it can be recommended that a ban be placed on the importation of these products once they are identified as containing mercury exceeding 1 part per million (ppm). A new technical regulation would also need to be implemented and the sensitisation of the Customs and Excise Division to improve surveillance. This, however, may not stop the illegal importation of this product. Thus, measures would need to be put in place to ensure the overall cooperativeness of the general public (*discussed further in Chapter 5 of this report*).

2.4 Data and Inventory on Other Intentional Products/ Process Uses of Mercury

2.4.1 Dental Mercury-Amalgam Fillings

Dental amalgam is used to fill cavities caused by tooth decay. It consists of a mixture of metals including liquid elemental mercury (which makes up approximately 50% of the amalgam by weight), silver, copper and tin (FDA, 2017). Due to its chemical properties, mercury can bind readily to the other metals in order to form the amalgam.

Amalgam can be delivered to dentists as pure mercury and a powder mix of the other metals which must be separately weighed out in the right proportions and mixed in an agitator at the clinic; or as a small capsule containing the required proportions of mercury and other metals that need only be mixed before application to the cavity. In general, mercury amalgam fillings can last between 10-20 years.

Most dental clinics use disposable chair side trap filters to trap amalgam residues generated during placement. Waste generated is either placed in biohazard waste containers or disposed of in general waste. Both types of waste are collected by the NSWMA and are delivered to the landfills, where they are buried deep within pits, separate from the municipal waste.

Mercury releases from dental amalgam fillings occur to the air, water and waste during the production of amalgam at factories; when amalgam is being prepared, placed, shaped or repaired at clinics; through natural wearing away in a person's mouth; during disposal of the amalgam after it is removed; and when a person with amalgam is buried or cremated after death (UNEP, 2019a).

In Antigua and Barbuda, dental amalgam has been used for years by both the public and private sectors. However, according to personnel from both public and private sectors, while dental amalgam is still used in the public sector due to its availability and low cost, it has been phased-out by most private clinics. Within the private sector, different alternatives such as composite resin and glass ionomers are used. Though costlier, these alternatives are more efficient, effective and safer than the dental amalgam. Further, they are the colour of natural teeth and are considered more aesthetic by users.

<u>Data Collection and Assessment</u>

Questionnaires and interviews with relevant personnel from the dental sector were the main source of information for this sub-category.

The amount of amalgam used annually in Antigua and Barbuda was not available. Additionally, there is no local data for the quantity of mercury in amalgams and therefore, default calculations derived from the Toolkit were used to obtain an estimate

of mercury input to society. These calculations utilised the number of dentists per 1,000 inhabitants as well as the number of inhabitants. Annex 8.4 of the Toolkit Reference Report stated that the number of dental personnel per 1000 inhabitants in Antigua and Barbuda was 0.1884 for the reference year of 1997. As current information was not available, it was assumed that the value did not change.

Population data from 2016 (100,963 inhabitants) was used to calculate the mercury input from the preparation of dental amalgam fillings at clinics in Antigua and Barbuda in 2016. Mercury input and releases occurring from the use of amalgam fillings in 2016 were expected to have been from amalgam placed 10 years prior in 2006 (90,301 inhabitants) since mercury amalgam can last between 10-20 years before needing to be replaced. Mercury input from the disposal of dental amalgam in 2016 was calculated using the country's population from 20 years prior, 1996 (75,628 inhabitants), due to the life expectancy of the fillings. Population data was sourced from available World Bank Database (2019).

The default output factors were also used to calculate the estimated releases into the different pathways.

According to the Toolkit, about 4.59 Kg Hg/y, 4.10 Kg Hg/y and 3.44 Kg Hg/y were input to society from dental amalgam prepared and placed in 2016, 2006 and 1996, respectively. Releases of mercury from dental amalgam fillings occur gradually over time and would not all be accounted for in the preparation year. Therefore, the overall input of mercury to society from the preparation, placement, use and disposal of dental amalgam in 2016 was calculated to be approximately 3.91 Kg Hg/y. Only dental chair filters and strainers are used in most clinics.

The summary of estimated inputs and releases of mercury from dental amalgam is provided in Table 14.

Table 14: Analysis of mercury inputs and outputs from the preparation, use and disposal of dental amalgam in 2016

Dental Mercury-Amalgam Fillings	Unit	Preparation	Use	Disposal
Activity rate	inhabitants	100,963 (2016)	90,301 (2006)	75,628 (1996)
Input factor for phase	g Hg/(y*inh)	0.2	0.2	0.2
Calculated input to phase	Kg Hg/y	4.59	4.10	3.44
Output distribution factors for phase:				
- Air	N/A	0.02	-	-
- Water	N/A	0.14	0.02	0.28
- Land	N/A	-	-	0.08
- Products	N/A	-	-	0.06
- General waste treatment	N/A	0.12	-	0.08
- Sector specific waste treatment	N/A	0.12	-	0.08
Calculated outputs/releases to:				
- Air	Kg Hg/y	0.09	-	-
- Water	Kg Hg/y	0.64	0.08	0.96
- Land	Kg Hg/y	-	-	0.28
- Products	Kg Hg/y	-	-	0.21
- General waste treatment	Kg Hg/y	0.55	-	0.28
- Sector specific waste treatment	Kg Hg/y	0.55	-	0.28

Data Gaps and Priorities for Potential Follow-Up

In order to determine a more accurate value for mercury releases from the preparation, use and disposal of dental amalgam in Antigua and Barbuda, historic data on the consumption of dental amalgam and the mercury content in the amalgam used is required. Further, information on the release of excess amalgam through wastewater in dental clinics, as well as existing disposal practices for removed amalgam, should be obtained.

In order to reduce the amount of mercury released from dental amalgam fillings, the public clinics could consider using different alternatives such as composite resin to fill cavities. Additionally, each dental clinic should develop an inventory system to track the amount of amalgam used and disposed of to aid in the collection of data for future inventories. The Department of Analytical Services has undertaken the collection of dental amalgam for storage to facilitate subsequent disposal. A robust collection regime should be implemented.

2.4.2 Manometers and Gauges with Mercury

Mercury is used in some manometers, gauges, pressure valves and other measuring devices (UNEP, 2019a). Its historical use in these products is due to its non-evaporating quality under normal conditions and its high and stable density (National Programme on Technology Enhanced Learning (NPTEL), n.d.). Globally, mercury containing equipment are being substituted by mercury-free alternatives.

Sphygmomanometers, barometers, hydrometers and other gauges that may contain mercury are imported into Antigua and Barbuda from other countries. Sphygmomanometers are used widely in the medical field to measure blood pressure, while barometers are used by the meteorological department for air pressure measurements. Hydrometers are used locally to measure the specific gravity and density of a liquid. Once intact, the mercury in these devices have minimal effect on the environment and humans as it is contained. However, if items are broken, mercury can be released into the atmosphere through vaporisation or to other pathways.

Most end of life items are collected and delivered to the Cooks Sanitary Landfill in Antigua or the Plantation Landfill in Barbuda, where they are buried with other wastes. Once buried, mercury could be released into waterways as leachate. Some spent instruments such as hydrometers are stockpiled at various organisations and are awaiting final disposal.

Data Collection and Assessment

Specific data on the number of medical blood pressure gauges imported and used in Antigua and Barbuda in 2016 was not obtained for this inventory. Instead, the number of sphygmomanometers distributed by the Antigua and Barbuda Central Medical Procurement Unit in 2017 (13) and 2018 (31) was provided. The Unit noted that 60 sphygmomanometers remained in its inventory.

The average number of sphygmomanometers distributed in 2017 and 2018, was found to be twenty-two (22) which was used as the activity rate for this category.

Customs data showed that 6,196 items “for measuring or checking pressure” were imported to Antigua and Barbuda in 2016 under HS Code 9026.20.00. The types of devices imported, and their mercury

content were not specified; therefore, default calculations for mercury input from the use and disposal of other manometers were used to determine the mercury releases from this source. 2016 population data (100,963) and electricity rates (97.355%) were used (World Bank, 2019).

The total input from the use and disposal of sphygmomanometers with mercury and other manometers in 2016 was estimated to be 1.76 Kg Hg/y and 0.49 Kg Hg/y, respectively. According to the default output distribution factors derived from the Toolkit, 1.35 Kg of mercury per year is released into the general waste, while 0.23 and 0.68 Kg of mercury per year are released to the air and water, respectively, from the use and disposal of manometers and gauges since no separate collection occurs with controlled waste handling.

A summary of estimated mercury releases from manometers and gauges is shown in Table 15.

Data Gaps and Priorities for Potential Follow-Up

The activity rate used to calculate the mercury input from the use and disposal of medical blood pressure gauges was the average amount of sphygmomanometers distributed by the Central Medical Procurement Unit in 2017 and 2018. This value is not representative of quantities used and disposed of nationally. Further, the actual quantity of mercury used in each item should be sourced. Although Customs data was available, the specific type of items imported, and their mercury content was not identified. Additional data should be recorded by Customs for use in future inventories.

Table 15: Analysis of mercury inputs and outputs from the use and disposal of manometers and gauges with mercury

Manometers and Gauges with Mercury	Unit	Use and Disposal	
		Medical Blood Pressure Gauges	Other Manometers
Activity rate	Items/y	22	-
	inhabitants	-	100,963
Input factor for phase	g Hg/item	80	-
	g Hg/y*inhabitant	-	0.005
Calculated input to phase	Kg Hg/y	1.76	0.49
Output distribution factors for phase:			
- Air	N/A	0.1	0.1
- Water	N/A	0.3	0.3
- Land	-	-	-
- Products	-	-	-
- General waste treatment	N/A	0.6	0.6
- Sector specific waste treatment	-	-	-
Calculated outputs/releases to:			
- Air	Kg Hg/y	0.18	0.05
- Water	Kg Hg/y	0.53	0.15
- Land	-	-	-
- Products	-	-	-
- General waste treatment	Kg Hg/y	1.06	0.29
- Sector specific waste treatment	-	-	-

2.4.3 Laboratory Chemicals and Equipment with Mercury

Mercury is used in laboratories as components of instruments and equipment, reagents, preservatives and catalysts (UNEP, 2019a). Some laboratory chemicals which contain mercury include mercury oxide (HgO), mercury chloride ($HgCl_2$), mercury sulphate ($HgSO_4$), and others which may be used in different experiments or for the preparation of other chemicals.

Globally, the total mercury content in many of the chemicals used in laboratories is low. Further, some mercury-added instruments and some methods using mercury have been substituted by mercury-free alternatives due to increasing availability of alternatives and awareness of the related risks (COWI and Concord East/West, 2008).

Mercury and mercury containing products used in various laboratories and schools in Antigua and Barbuda are typically imported. Spent chemicals and instruments containing mercury are usually stockpiled within the laboratories until disposal can be executed. However, institutions and laboratories have communicated a need for the collection of stockpiles of chemicals and equipment with mercury for proper disposal by the NSWMA. The NSWMA seeks in the future to use lined drums to store these products until proper disposal can take place.

The mercury within the chemicals and equipment in laboratories can be released to various pathways during their life cycle. Mercury vapours can be released from chemicals during use and when stockpiled or disposed improperly at the landfills. Mercury can also be released into waterways if, for example, a technician or student disposes of a chemical containing mercury down the drain or washes a container in the sink. Mercury can be released into general waste via improper disposal of an instrument or chemical in the garbage. This would be delivered to the Cooks Landfill in Antigua or the Plantation Landfill in Barbuda and be buried with other wastes. The mercury then would be released into the ground or as leachate.

Data Collection and Assessment

Interviews were conducted with lab technicians from various institutions and personnel from the Department of Analytical Services to obtain information for this sub-category. The main chemicals and compounds containing mercury that were used by laboratories in Antigua and Barbuda are mercury chloride, mercury oxide and mercury metal. The importation data for these chemicals and equipment is currently unavailable, so default calculations in the Toolkit Spreadsheet were used to estimate input from this source category.

The 2016 population (100,963) and electrification rate (97.355%) were used as the activity rate in these default calculations. The default input factors of 0.01 and 0.04 grams of mercury per year per inhabitant were used to estimate the mercury input to society from laboratory chemicals and other lab equipment, respectively. Default output factors from the Toolkit were used to estimate mercury releases.

The mercury input to Antigua and Barbuda from the use and disposal of laboratory chemicals and equipment containing mercury was determined to be approximately 4.91 Kg Hg/y. A summary of mercury inputs and releases is provided in Table 16.

Table 16: Analysis of mercury inputs and outputs from the use and disposal of laboratory chemicals and equipment with mercury

Laboratory Chemicals and Equipment with Mercury	Unit	Use and Disposal	
		Laboratory Chemicals	Other Laboratory Equipment
Activity rate	inhabitants	100,963	100,963
Input factor for phase	g Hg/y*inhabitant	0.01	0.04
Calculated input to phase	Kg Hg/y	0.98	3.93
Output distribution factors for phase:			
- Air	-	-	-
- Water	N/A	0.33	0.33
- Land	-	-	-
- Products	-	-	-
- General waste treatment	N/A	0.33	0.33
- Sector specific waste treatment	N/A	0.34	0.34
Calculated outputs/releases to:			
- Air	-	-	-
- Water	Kg Hg/y	0.32	1.30
- Land	-	-	-
- Products	-	-	-
- General waste treatment	Kg Hg/y	0.32	1.30
- Sector specific waste treatment	Kg Hg/y	0.33	1.34

Data Gaps and Priorities for Potential Follow-Up

Default calculations were used to estimate the mercury inputs and releases from this source category. As such, the quantification of the mercury-containing chemicals and equipment used in Antigua and Barbuda is necessary to accurately approximate the amount of mercury being released into the environment from this source.

The implementation of a proper management system for the use and disposal of chemicals and equipment containing mercury within schools and laboratories in the nation is needed to aid in data collection.

2.5 Data and Inventory on Waste Incineration

Waste incineration is a waste treatment and disposal process which includes the combustion of waste under controlled or informal conditions to reduce volume, break down hazardous components or produce energy. The main categories of waste incineration include municipal/general waste incineration, hazardous waste incineration, medical waste incineration, sewage sludge incineration and informal waste incineration (UNEP, 2019a). Mercury can be emitted through these processes when the element and its compounds are contained in the incinerated material. The primary release pathway for this category is to the air. The quantity of mercury released depends on the content of mercury in products, and the presence of mercury emission controls.

In Antigua and Barbuda, medical waste incineration and informal burning of wastes occur.

2.5.1 Incineration of Medical Waste

Medical waste is any waste generated from medical activities taking place at hospitals, healthcare facilities, dental clinics, etc. Waste generated from these activities usually include human secretions, pharmaceuticals, packaging materials and various tools used in medical treatment. Incineration is usually used to destroy different toxins, pathogens and viruses contained within the waste (UNEP, 2019a).

The concentration of mercury within incinerated waste is dependent on the amount of mercury contained in products and equipment included in the incinerated waste. The incineration of medical waste including sharps (needles or other sharp objects) and their respective containers, surgical waste, biomedical waste and plastics, takes place at the MSJMC using a MediBurn diesel-fueled medical waste incinerator. After incineration, the residues are delivered to the Cooks Landfill where they are buried within pits. It is expected that most of the mercury; however, is emitted as vapour during the incineration process.

Data Collection and Assessment

Information for this source category was obtained from the National Inventory Report for Unintentional Persistent Organic Pollutants (UPOPs) in Antigua and Barbuda (BCRC-Caribbean, 2016) in which interviews with personnel from the MSJMC were conducted and it was estimated that 7.8 tonnes of medical waste was incinerated in a year. The default mercury input factor derived from the Toolkit was used to estimate the mercury input to Antigua and Barbuda from this category.

It was noted that no mercury emission controls are present in the incinerator. As such, it is expected that all of the mercury input is released to air. Details on this category are included in Table 17.

Table 17: Analysis of mercury inputs and outputs from the incineration of medical waste

Incineration of Medical Waste	Unit	Incineration
Activity rate	Waste incinerated, t/y	7.8
Input factor for phase	g Hg/t waste incinerated	24
Calculated input to phase	Kg Hg/y	0.19
Output distribution factors for phase:		
- Air	N/A	1
- Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	Kg Hg/y	0.19
- Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

Data Gaps and Priorities for Potential Follow-Up

It is recommended that a management system be put in place to ensure the maintenance of records on the types of waste incinerated. Emission controls should be added to the incinerator to reduce the amount of mercury being released to the atmosphere. If this is implemented, data on the captured mercury and measures for disposal should be gathered for input into future inventories.

2.5.2 Informal Waste Burning

Informal waste burning can be described as waste incineration that is conducted under uncontrolled conditions, with no emission controls and with diffuse spreading of incineration residues on land (UNEP, 2019a). If mercury-added products are incorporated in the waste being burned, the mercury contained in these products can be released into the atmosphere upon combustion. These toxic emissions pose a risk to the health of individuals, especially those who live in surrounding communities.

The informal incineration of waste has been a prevalent issue in Antigua and Barbuda. It is undertaken by some locals for the removal of household wastes including mercury-added products. In Antigua and Barbuda, fire permits must be issued in order for anyone to burn waste. Despite the law, locals burn waste when convenient to them without obtaining a permit.

Landfill fires are another source of informal waste burning which occurs sporadically at the Cooks Landfill in Antigua. According to NSWMA, these fires occur about two (2) to three (3) times a year due to the ignition of methane gas which is produced from the decomposition of deposited organic municipal wastes at the landfill. Once ignited, a landfill fire can start, emitting mercury from buried wastes containing the metal element.

Data Collection and Assessment

Information for this source category was obtained from the National Inventory Report for UPOPs in Antigua and Barbuda (BCRC-Caribbean, 2016).

Approximately 1,000 tonnes of waste is burned monthly at the Plantation Landfill in Barbuda (BCRC-Caribbean, 2016). Stakeholders noted that this waste was primarily green waste; as such, a low mercury input factor (1 g Hg/t waste) was used in the Toolkit calculations. Additional data on the quantity and type of waste burned informally throughout the country was not available.

The calculated mercury input from informal waste burning was estimated to be 12 Kg Hg/y. However, since mercury from this source is primarily from mercury released to general waste from the intentional use of mercury in products, only 1.2 Kg Hg/y from this source is included in the total mercury inputs to Antigua and Barbuda to avoid double counting. Releases from this source are to air as no emission controls are typically used for informal waste burning.

The summary of estimated inputs and releases of mercury from waste informally burned is shown in Table 18.

Table 18: Analysis of mercury inputs and outputs from informal waste burning

Informal Waste Burning	Unit	Informal Burning
Activity rate	Waste burned, t/y	12,000
Input factor for phase	g Hg/t waste	1
Calculated input to phase	Kg Hg/y	12

Informal Waste Burning	Unit	Informal Burning
Output distribution factors for phase:		
- Air	N/A	1
- Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	Kg Hg/y	12
-Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

Data Gaps and Priorities for Potential Follow-Up

The quantity of waste informally burned throughout Antigua and Barbuda should be estimated for input in future inventories. The mercury content of these wastes should also be determined as well as the distribution pathways for mercury released from this source category.

Legislation and enforcement regarding informal burning should be strengthened in order to support data collection for this source category. This should be coupled with increased awareness of the possible health risk and effects of mercury exposure through the practice of intentional and unintentional burning of waste.

2.6 Data and Inventory on Waste Deposition/Landfilling and Wastewater Treatment

This source category assesses mercury inputs and releases from the disposal of wastes through controlled landfills/deposits, diffuse deposition under some control, informal local deposition of industrial production waste, informal waste dumping and wastewater system/treatment.

According the Toolkit Reference Report (UNEP, 2019a), mercury in these sources originates from three main groups:

1) Intentionally used mercury in spent products and process waste;
2) Natural mercury impurities in bulk materials and minerals; and
3) Mercury as an anthropogenic trace pollutant in bulk materials.

In this regard, waste disposal is a secondary source of mercury input to society.

In Antigua and Barbuda, identified sources include controlled landfills and informal dumping of general wastes.

There is no wastewater treatment facility available to treat wastewater and dispose of it correctly within Antigua and Barbuda. Most domestic premises in the nation use soak-away/septic-tank systems, drain fields and pit latrines as a primary level of treatment. This level of treatment only separates the large debris from smaller debris and does not remove any toxic elements which can create a health hazard.

The Caribbean Water Treatment Ltd. has strategised plans to build an efficient, environmentally sound water treatment

facility that would provide a medium to alleviate the impact of wastewater in the environment (Caribbean Water Treatment Ltd, 2009). At present, the relevant assessments for selection of a suitable location for the facility are underway.

The absence of a public wastewater treatment facility has resulted in no available quantification of the amount of wastewater treated locally. There are a few hotels on the island that have sewage treatment facilities for private use, but the amount of wastewater from these hotels is not known. Additional attempts must be made to gain information from this source as it would give some insight into the mercury content in wastewater and its output distribution pathways.

2.6.1 Controlled Landfills/ Deposits

A sanitary landfill is an area for waste deposition which is specially designed to prevent releases and emissions of waste components to the environment. Some design attributes may include linings made up of impermeable materials such as clay or leachate ponds to isolate liquid components from the environment. Wastes deposited in landfills that do not have efficient built-in measures to prevent releases can lead to the contamination of surrounding areas with hazardous waste components including mercury.

The mercury content in the municipal waste may be due to discarded mercury-added products such as batteries and fluorescent lighting products (UNEP, 2019a). When the mercury-added products are damaged or broken, mercury contained within the item can be released into the air by evaporation. Small amounts of mercury can also be released into waterways.

Antigua and Barbuda has two (2) landfills, the Cooks Sanitary Landfill in Antigua and the Plantation Landfill located in Barbuda. The Cooks Sanitary Landfill is managed by the NSWMA, while the Plantation Landfill is governed by the Barbuda Council.

Cooks Sanitary Landfill, Antigua

The landfill located in Cooks Estate, Antigua (circa 1991) was once an unmanaged dump where waste was improperly disposed in unlined areas with inadequate ventilation for gases and widespread open burning was practiced. These poor practices resulted in the contamination of groundwater surrounding the site and fires resulting from the build-up of gases. NSWMA, in collaboration with the Central Board of Health (CBH), sought to rectify these issues through the construction of a new sanitary landfill in 2001. The new site began operations in 2006 and was equipped with a cell operating structure combined with a leachate collection system, mild leachate treatment and gas vents.

There is no official comprehensive sorting mechanism at Cooks Landfill; however, cursory inspection is done to separate some wastes such as discarded machinery and some larger electronics, from general streams before burial in landfill cells. Separated wastes are stockpiled on site. Biomedical waste, hazardous waste and sewage brought directly to the landfill are buried in separate pits deep within the landfill.

According to the NSWMA, the capacity of the sanitary landfill has been exceeded, and the old dump site is being used for waste deposition.

Plantation Landfill, Barbuda

The Plantation landfill in Barbuda was an unregulated dump prior to 2008 when NSWMA, along with the CBH, began construction of a lined landfill with a leachate collection system. Like the Cooks Sanitary Landfill in Antigua, municipal waste, bulky waste and green waste are

delivered to the Plantation landfill and buried within pits. Medical and hazardous wastes are buried in a special cell apart from general wastes.

Due to a lack of financial resources and relevant equipment such as a truck loader, it has been noted that the Plantation Landfill still requires additional resources to function efficiently. In 2017, widespread damage caused by Hurricane Irma, left the landfill inoperable.

Data Collection and Assessment

According to NSWMA, the main types of waste delivered to the Cooks landfill include bulky waste, municipal waste and green waste (Table 19). The same types of waste are delivered to the Plantation Landfill; however, there is no available data for waste collected in Barbuda as all documents were destroyed by Hurricane Irma in 2017.

Table 19: Amount of waste collected at Cooks Landfill, Antigua in 2016

Category of Waste	Amount of Waste (t/y)
Household	21,531.38
Industrial	175.68
Commercial	9,859.15
Institutional	291.45
Medical	8.00
Construction and Demolition	7,856.94
Clean Bulk	1,333.89
Bulk Waste	40,151.35
Cruise Ship	217.07
Street Sweep	456.33
Sewage	13,828.07
Tyres	766.40
Total	**96,475.71**

There is no local data for the mercury content in landfilled wastes in Antigua and Barbuda. Therefore, the input factor of 5 grams of mercury per tonne of waste suggested by the Toolkit was used to estimate the mercury input from waste disposed at the Cooks Landfill in 2016. Default output distribution factors in the Toolkit were used to determine mercury releases from this source category.

Based on the calculations, the estimated total mercury present in waste deposited at the Cooks Landfill in 2016 is 482 Kg Hg/y, and the approximate mercury input to Antigua is 4.87 Kg Hg/y. Since mercury from this source is primarily from mercury released to general waste from the intentional use of mercury in products, only 10% of mercury input from the disposal of wastes at the Cooks Landfill (0.49 Kg Hg/y) is included in the total mercury inputs to Antigua and Barbuda to avoid double counting. Releases of mercury from this source category are to air (4.82 Kg Hg/y) and to water (0.05 Kg Hg/y).

Table 20 shows a summary of mercury inputs and releases from the Cooks landfill in Antigua.

Data Gaps and Priorities for Potential Follow-Up

The activity rate used to calculate mercury inputs and outputs for this source category did not include the quantity of waste deposited in the Plantation Landfill in Barbuda since this data was not available. As such, additional information is needed to estimate the mercury input to Barbuda from landfilled wastes.

Default input and output factors derived from the Toolkit were used. Local data on the mercury concentration in wastes deposited at the landfills should be determined. Local information on the distribution pathways for mercury releases from controlled landfills should also be sourced.

It is recommended that a separation and sorting mechanism for discarded mercury-added products be implemented to control

the amount of mercury that is released into the environment from waste deposited at the landfills.

Table 20: Analysis of mercury inputs and outputs from controlled landfills/deposits

Controlled Landfills/ Deposits	Unit	Controlled Landfills
Activity rate	Waste landfilled, t/y	96,475.71
Input factor for phase	g Hg/t waste	5
Calculated input to phase	Kg Hg/y	482
Output distribution factors for phase:		
- Air	N/A	0.01
- Water	N/A	0.0001
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	Kg Hg/y	4.82
-Water	Kg Hg/y	0.05
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

2.6.2 Informal Dumping of General Waste

Informal dumping of waste refers to the disposal of discarded material without measures to minimise releases and emissions of pollutants into the environment (UNEP, 2019a). The accumulation of informally dumped waste mercury-added products can lead to releases of mercury to the soil, air, ground water and surface water, particularly when these products are damaged or broken.

In Antigua and Barbuda, informal dumping of waste is considered an illegal act and is subject to fines under the Control and Prevention Act 2019. However, this practice takes place as locals sometimes dump household waste in unofficial dump sites throughout the island.

Data Gaps and Priorities for Potential Follow-Up

Due to the informal nature of this practice and a lack of official records, the amount of waste dumped informally in Antigua and Barbuda was not quantified for this inventory.

With the enforcement of the Litter Control and Prevention Act 2019, outputs from this practice are likely to reduce further; however, through enforcement efforts, considerations could be made to quantify and classify the waste found at illegal dumpsites found within Antigua and Barbuda.

2.6.3 Test of Waste Default Factors

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

The test made for general waste compares the calculated inputs to all four general waste subcategories; i.e. incineration of municipal/ general waste (E62[5]), informal waste burning (E66), controlled landfills/deposits (E68), and informal dumping of general waste (E71), with the sum of general waste outputs from the intentional use of mercury in products and processes (J42 to J56) as follows, using data from the Inventory Level 2 Spreadsheet.

In the spreadsheet, the test was done as follows;

Tab "Level 2-Summary":
(E62+E66+E68+E71) > 2*(Σ (J42 to J56))
16.87 kg > 2*(13.73 kg)

The derived expression is false as 16.87 kg is less than 27.46 kg. Therefore, the calculations made indicate that the default input factors for general waste do not necessarily over-estimate the mercury releases from these sub-categories. It is important to note, however, that there are data gaps for mercury releases from several categories of products and processes, and the quantities of general waste disposed through waste deposition at the Plantation landfill in Barbuda and informal dumping were not determined.

2.7 Data and Inventory on Crematoria and Cemeteries

Mercury can accumulate in humans through the use of dental amalgam, exposure to mercury contained in products and intentionally used in processes, and consumption of mercury contaminated aquatic species. This mercury may be released after death when a corpse is cremated or buried.

There are no crematories in Antigua and Barbuda, so a small percentage of corpses are shipped to nearby countries for cremation.

2.7.1 Cemeteries

During decomposition, mercury in human corpses can be released into the soil in cemeteries.

The main cemeteries used for public burials are the St. John's Public Cemetery in Antigua and the Barbuda Public Cemetery in Barbuda. Many churches across both islands also contain smaller burial plots.

Data Collection and Assessment

The 2016 burial rate for Antigua and Barbuda was obtained from the Statistics Division. In 2016, 542 persons were buried in Antigua and Barbuda.

There is no local data for the amount of mercury contained in each corpse, therefore, the default input factor from the Toolkit was used to estimate the mercury input from this category. Based on the default input factor, 1.36 Kg Hg/y was input to Antigua and Barbuda from burials in 2016 and following adjustments made for dental personnel density as dental amalgam is the major contributor to mercury in the human body the input factor from burial was found to be 0.49 Kg Hg/y. The sole release pathway for mercury from cemeteries is the land.

Table 21 shows the summary of mercury inputs and releases from cemeteries in Antigua and Barbuda in 2016.

[5] Figure refers to the relevant cell number on the Toolkit spreadsheet tab "Summary". The Toolkit Spreadsheet is available as Annex 3 of this report.

Table 21: Analysis of mercury inputs and outputs from cemeteries

Cemeteries	Unit	Cemeteries
Activity rate	Corpses buried/y	542
Input factor for phase	g Hg/corpse	4
Adjustment for dental personnel density as dental amalgam is the major contributor to mercury in the human body	Dentist per 1000 inhabitants, country	0.1884
Calculated input to phase	Kg Hg/y	0.493
Output distribution factors for phase:		
- Air	-	-
- Water	-	-
- Land	N/A	1
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	-	-
-Water	-	-
- Land	Kg Hg/y	0.493
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

2.8 Stocks of Mercury and/or Mercury Compounds and Storage Conditions

As per Article 3, Part 1 of the Minamata Convention on Mercury, “mercury” and “mercury containing compounds” refer to mixtures of mercury with other substances, mercury (I) chloride, mercury (II) oxide, mercury (II) sulphate, mercury (II) nitrate, cinnabar and mercury sulphide.

Article 3, Part 5a states that each Party shall endeavour to identify individual stocks of mercury or mercury compounds (not including mercury-added products) over 50 tonnes. If any such stocks are identified, Article 10 of the Convention regarding environmentally sound interim storage of mercury, other than waste mercury, would also apply.

Antigua and Barbuda does not have any notable stocks of mercury and/or mercury compounds.

2.9 Supply and Trade of Mercury and Mercury Containing Compounds Including Sources, Recycling Activities and Quantities

Article 3 of the Minamata Convention also lists provisions for Parties to regulate the supply, export and disposal of mercury and mercury containing compounds. Part 5a states that each Party shall endeavour to identify sources of mercury supply generating stocks exceeding 10 tonnes per year, that are located within its territory.

Based on the inventory, it was determined that no significant sources, trade, or recycling of mercury and/or mercury compounds are present in Antigua and Barbuda, and, therefore the interim storage provisions outlined in Article 10 of the Minamata Convention are not applicable to Antigua and Barbuda.

2.10 Identified Hot Spots of Mercury Contamination (Contaminated Sites)

Article 12 of the Minamata Convention on Mercury states that Parties should "develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds". Risk reduction activities should be conducted using environmentally sound measures and should incorporate an assessment of the risks to human and environmental health from present mercury or mercury compounds.

Hot spots of mercury contamination exist as the direct result of the use and release of mercury in processes leading to on-site deposition, as well as the inadequate disposal of mercury-contaminated materials. Previous deposits of mercury may still have the potential to release significant amounts of mercury and pose a risk to human health and the environment. Potential hot spots may include reservoirs where mercury containing materials have been stored, dumped or accumulated over many years.

In Antigua and Barbuda, potential mercury contaminated sites are primarily due to the disposal of mercury containing or contaminated products at landfills or other disposal sites. Table 22 shows sites that were identified as potential mercury hot spots in Antigua and Barbuda.

Table 22: Summary of potentially mercury contaminated sites in Antigua and Barbuda

Potentially contaminated site	Summary description
Cooks Sanitary Landfill Cooks Estate, St. John's, Antigua	Most spent products containing mercury from Antigua are disposed of at this site. Historically, there have been limited sorting mechanisms for wastes at the landfill. Bulb crushing equipment is present; however, since there are limited collection programmes, most bulbs are still buried with other wastes in the landfill cells. There is currently no remediation plan for the landfill under the National Solid Waste Management Authority. However, waste management plans are being conceptualised.
Plantation Landfill Plantation, Barbuda	Products containing mercury from Barbuda are disposed of at this site. There are no sorting mechanisms for the waste disposed of at the landfill. There is currently no ongoing remediation plan under the National Solid Waste Management Authority. However, waste management plans are being conceptualised.
Burma Dumpsite Fitches Creek, Antigua	Prior to the 1990s, this site was used for the disposal of municipal waste and medical waste from the local hospital. The site is no longer in use; however, mercury releases may have occurred to land, groundwater and general waste from mercury-containing products.

Potentially contaminated site	Summary description
Illegal Dumpsite Pigotts Village, opposite Government Motor Pool, Antigua	The site is an one-eighth acre of land which was being used illegally for the dumping of waste. There are no measures in place to control releases of mercury from the deposited items. Legal action has been taken to stop the illegal dumping, and government officials are hopeful that the new Litter and Prevention Bill 2018 will encourage persons to cease the practice.

Mercury from these contaminated sites may be released into watersheds and other ecosystems where it can be converted into the element's more toxic organic form, methylmercury, through microbial activity.

In order to assist Antigua and Barbuda in the identification of watersheds which are sensitive to the methylation of mercury, Biodiversity Research Institute (BRI) conducted a rapid assessment of watershed sensitivities. This was done through the collection of national-scale spatial data on watersheds, the location of potentially contaminated sites and other mercury point sources. The data obtained was used as a tool to improve understanding of and to identify areas that may be sensitive to mercury contamination in order to improve monitoring and mitigation efforts.

Watershed and catchment units were used as the units of analysis due to characteristics of mercury contamination in the environment (BRI, 2019). Predictor variables based on existing data were also assigned for both islands. The Percentage cover of mangroves; forest cover; agriculture; waterbodies; and swamps were analysed as well as the Occurrence data of landfills and disposal sites. Geographic Information Systems (GIS) datasets sourced from local stakeholders were used to determine spatial land coverage.

In Antigua and Barbuda, 254 and 41 watershed and catchment areas were analysed, respectively.

Watershed Hg Sensitivity was rated on a scale of 0.0 (not sensitive to methylation of mercury) – 1.0 (most sensitive to methylation of mercury).

Neither island was found to have high watershed sensitivities between 0.8 – 1.0. However, 22.4% (57) and 19.5% (8) of the watersheds in Antigua and Barbuda, respectively, had sensitivities between 0.6 – 0.8 (*highlighted in orange on Figure 5*).

The variations in watershed sensitivities to the methylation of mercury in Antigua and Barbuda were found to be driven by the spatial distribution of mangroves. In Barbuda, the presence of swamps was a secondary contributor to watersheds with higher sensitivities. Potentially mercury contaminated sites such as landfills and dumpsites on both islands are located within watersheds that were found to have sensitivities between 0.6 – 0.8.

The results from the rapid assessment can be used to provide information on the potential of relating land coverage to mercury exposure risk. To further optimise the analysis, the presence and location of additional potential sources of mercury should be verified by relevant authorities in Antigua and Barbuda.

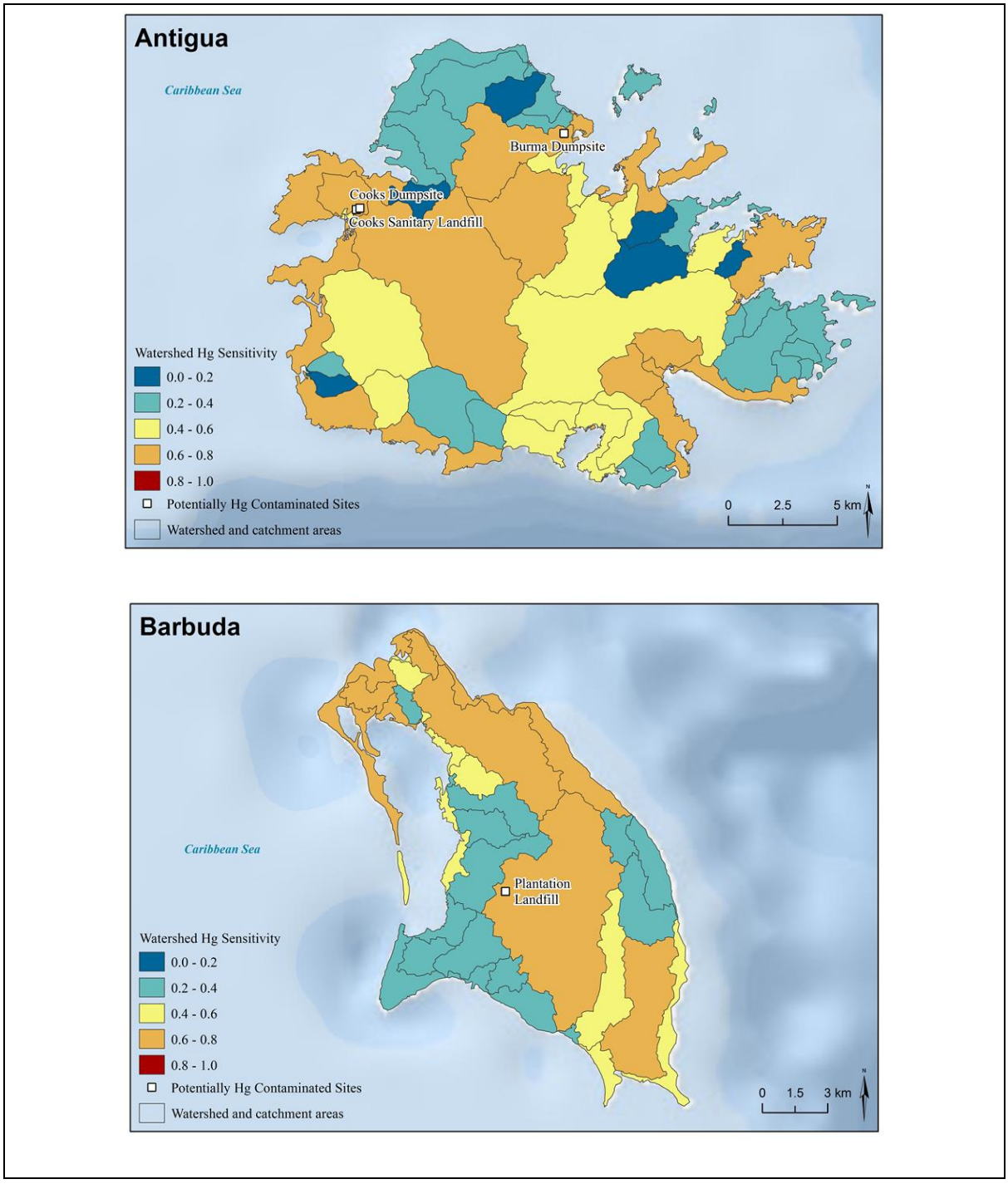

Figure 5: Watershed mercury sensitivity in Antigua and Barbuda (Source: BRI, 2019)

Chapter 3 Policy, Regulatory and Institutional Framework Assessment

Antigua and Barbuda acceded to the Minamata Convention on September 23, 2016, becoming the second country in the English-speaking Caribbean, behind Guyana, to do so. However, only finite steps have been taken by the country to implement the obligations established for Parties to the Convention. Developing country Parties like Antigua and Barbuda confront deficiencies in their policy, legal and institutional governance arrangements in order to implement Convention obligations. This duty places even more burdens on the country's restricted administrative capacity and financial resources.

To determine Antigua and Barbuda's capacity to implement the Minamata Convention, an assessment of the country's policy, legislative and institutional capacity related to mercury management and implementation of the Minamata Convention was undertaken. The information provided in the assessment report was the result of intense scrutiny of multiple pieces of legislation and policies that touch on and concern the management of wastes and chemicals in the country and discusses the strengths, weaknesses and gaps of these legislations and policies within the context of mercury management. The following section summarises the results obtained for Antigua and Barbuda.

3.1 Existing Policy and Regulatory Framework Related to Mercury Management

A strong policy and regulatory framework is critical to the implementation of the Minamata Convention as it sets the foundation for actions taken by Ministries and by other stakeholders and serves as the authorisation documents for several key decisions on any issue. Similarly, an assessment of the national framework relevant to the management of mercury, mercury compounds and mercury-added products in Antigua and Barbuda is important to ascertaining whether there is an existing system that can accommodate the actions required to be taken under the Convention.

The existing and draft policies and legislation that are directly or indirectly relevant to the management of mercury in Antigua and Barbuda were reviewed and analysed according to their goals and objectives. Table 23 describes the instruments found to be directly relevant to mercury management.

Table 23: Summary of policies and legislation reviewed and directly relevant to mercury management in Antigua and Barbuda

Instrument	Responsible Ministry/ Body/ Agency	Objective of Legal Instrument	Relevance to Mercury Management
Regional/ International Agreements			
Minamata Convention on Mercury	Director, Department of Analytical Services, Ministry of Agriculture, Fisheries and Barbuda Affairs ***(Competent Authority and Focal Point)***	To protect human health and the environment from the adverse effects of mercury.	Controlling the anthropogenic releases of mercury throughout its life cycle has been a key factor in shaping the obligations under the Convention.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989	Registrar of Pesticides and Toxic Chemicals, Ministry of Agriculture, Fisheries and Barbuda Affairs ***(Competent Authority)*** Director, Department of Analytical Services ***(Competent Authority and Focal Point)***	To protect human health and the environment against the adverse effects of the transboundary movements and disposal of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" - household waste and incinerator ash.	Wastes having constituents of mercury and mercury compounds are included in Annex 1 of the Basel Convention and are therefore subject to the requirements listed by the Convention. Technical guidelines for the environmentally sound management of wastes consisting of elemental mercury and wastes containing or contaminated with mercury were developed under this Convention. The relevant definitions of mercury wastes and guidelines developed under the Basel Convention are also applicable for the implementation of the Minamata Convention on Mercury.
St. Georges Declaration of Principles for Environmental Sustainability in the Organisation of Eastern Caribbean States (OECS) (Revised 2006)	Department of Environment, Ministry of Health, Wellness and Environment	The Declaration is a framework document that incorporates principles from the Barbados Plan of Action for small island developing states and is the adaptation of the regional principles of the Rio Declaration and other international agreements that have been adapted to the national situation in ANU. An updated "St. George's (OECS) Declaration on environment and other issues (SDG)" has been developed which considers the Sustainable Development Goals (SDGs). The revision broadly sets out the framework	The Declaration mandates ANU to adopt the precautionary approach in establishing an environmentally sound framework for the management of solid wastes and hazardous wastes and substances. Although not specifically mentioned, the framework could be interpreted to include pollution controls for discharges of mercury. The Strategy requires OECS countries to establish mechanisms for the implementation of national policies on waste, pollution control and chemicals management.

Instrument	Responsible Ministry/ Body/ Agency	Objective of Legal Instrument	Relevance to Mercury Management
		to be pursued for environmental management in the OECS region. The implementing document is the "OECS Environmental Management Strategy" which outlines the aim to protect, conserve and enhance or restore, where appropriate, the quality and value of the region's natural resources in order to sustain social and economic development for present and future generations.	
National Policies			
National Environmental Management Strategy (NEMS) and Action Plan, 2004 – 2009	Department of Environment, Ministry of Health, Wellness and Environment	Integrates all aspects of environmental management including hazardous wastes, ozone depletion, climate change, water quality, air quality, watershed, wetland, biodiversity and forestry management into decision-making. Supported by the Environment Management Act No. 11 of 2015.	The definition of hazardous waste is synonymous with that of the Basel Convention. As such, by this Plan, wastes having constituents of mercury and mercury compounds are included as hazardous waste; however, a specific strategy for managing hazardous wastes, such as mercury, is not outlined. This Plan is outdated.
Draft National Solid Waste Management Authority Strategic Plan (2014-2029)	National Solid Waste Management Authority	Mandates the design, development and implementation of a comprehensive strategic waste management plan.	Although the Draft Plan does not specifically reference wastes containing mercury, the Draft Plan aims to address waste management challenges which have implications for national mercury management, including waste storage, illegal dumping of wastes and waste disposal, etc.
National Legislation			
Environmental Protection and Management Act No. 11 of 2015	Department of Environment, Ministry of Health, Wellness and Environment	Governs *inter alia*, sustainable environmental management and monitoring, and pollution control. Lists controlled substances and prohibited wastes, and wastes requiring special permits for dumping. Requires establishment of	The Minamata Convention should be listed in Schedule IX as a MEA which is to be incorporated into national law. Mercury and mercury compounds are listed as prohibited wastes in Schedule II; water quality standards to protect human health, aquatic life and aesthetic qualities from mercury are listed in Schedule IV; wastes having as

Instrument	Responsible Ministry/ Body/ Agency	Objective of Legal Instrument	Relevance to Mercury Management
		permissible emission levels and of environmental quality standards, outlines draft water quality management criteria and guidelines and air quality criteria for point and non-point sources. Gives the force of law to the MEAs specified in Schedule IX and establishes responsibility for the implementation of all international instruments through a National Implementing Committee.	constituents mercury and mercury compounds (Y29) are identified as hazardous substances in Annex I of Schedule VII.
Pesticides and Toxic Chemicals Act, 2008	Pesticides and Toxic Chemicals Control Board, Ministry of Agriculture, Fisheries and Barbuda Affairs	Aims to regulate the use of pesticides and toxic chemicals in Antigua and Barbuda. Persons are prohibited from manufacturing, importing, selling, storing in marketable quantities or transporting a controlled product unless it is registered as prescribed.	This Act may be considered as providing a framework under which mercury and its compounds may be managed. Mercuric chloride is categorised under Schedule 2 as a Class 1 A extremely hazardous pesticide, and phenylmercury acetate is listed as a Class 1b highly hazardous pesticide. Both products are controlled. Other forms of mercury are not mentioned; however, the Minister of Agriculture may, by regulation, amend Schedule 2 after consultation with, or on the recommendation of, the Board.
National Solid Waste Management Authority Act No. 10 of 1995 (as amended 2005)	National Solid Waste Management Authority (NSWMA)	Governs the management and disposal of all waste in Antigua and Barbuda and vests the NSWMA with responsibility for storage, collection, treatment, and disposal of solid waste. Provisions for the remediation of waste management facilities is included under this Act.	Annex 1 category Y29 of the Second Schedule includes wastes having constituents of mercury and mercury compounds as “hazardous” wastes (as per the 2005 amendment). No regulations or guidelines have been developed under this Act for the reduction and/or management of mercury containing products and wastes.

Instrument	Responsible Ministry/ Body/ Agency	Objective of Legal Instrument	Relevance to Mercury Management
Litter Control and Prevention Act, 2019 (replaced the Litter Act (1983) and the Litter (Amendment) Act, 2007)	Central Board of Health	Manages the issue of litter through provisions for monitoring and prevention of littering. Identifies responsibilities and chain of custody for the disposal of various waste streams.	Litter defined to mean “anything whatsoever” and could include mercury added products e.g. batteries and fluorescent lightbulbs. This Act can be considered for the implementation of mercury waste management.
Antigua Public Utilities Act 1973	Antigua Public Utilities Authority (APUA)	Regulates the control of sewage, wastewater, wastes and pollutants of water resources. There is no centralised system for the collection, treatment, and disposal of sewage.	Provides controls over sewage disposal and could be used to establish mechanisms to monitor and regulate mercury content in discharges.
Customs (Control and Management) Act 1993 and its Amendment, 2013	Comptroller of Customs, Customs and Excise Division	Prohibits or restricts the entry or exit of goods or chemicals into or out of ANU based on existing prohibitions or restrictions by or under other legislation. According to the provisions, the Customs and Excise Division has control of all goods entering Antigua and Barbuda (except those goods described under section 35) over which it may restrict or prohibit their importation.	Part I and II of the Third Schedule prohibits certain goods from being imported into Antigua and Barbuda and includes the importation of goods which are prohibited by any other law of the State. Mercury and mercury-added products are not listed in Part I of the Third Schedule; however, the Minister of Finance and Corporate Governance may amend the Schedule at any time to prohibit items containing mercury from being imported, landed or unloaded in ANU.
Ports Authority Act Cap 333	Antigua and Barbuda Port Authority	Sets up a Port Authority which is vested with the power and duty to provide, manage, and maintain efficient port services and facilities.	The Authority determines conditions upon which goods, such as mercury and mercury-added products, shall be carried or warehoused.

Instrument	Responsible Ministry/ Body/ Agency	Objective of Legal Instrument	Relevance to Mercury Management
Standards Bill, 2017	Antigua and Barbuda Bureau of Standards	Replaces the Standards Act Cap 411. Promotes and encourages the maintenance of standards in relation to goods, services, processes and practices.	The Bureau of Standards can develop standards for goods, including mercury containing consumer products, or adopt international standards. The Minister of Foreign Affairs, International Trade and Immigration may, by Order, declare standards to be compulsory. Developed standards will determine, if not immediately ban, the entry of mercury products into the country.
Occupational Health and Safety Act, 2015	Department of Labour, Ministry of Legal Affairs, Public Safety and Labour	Provides for the safety, health, and welfare of persons at work, occupational safety and health standards in Antigua and Barbuda. The Act also makes provision for the handling, storage, use, disposal, and transport of dangerous substances.	Strategies to educate and prevent occupational and health-related exposure to mercury are encouraged under the Minamata Convention. Amendments to include special provisions regarding mercury can be considered.
Public Health Act Cap No. 353 of 1957 (as amended 1965, 2017, 2018)	National Solid Waste Management Authority, Ministry of Health, Wellness and Environment	This Act makes provisions for dealing with nuisances including matters that may be injurious to public health.	Of importance to the public health aspects of the Minamata Convention.

Other policies and legislation that may be indirectly relevant to the implementation of the Minamata Convention are summarised in Table 24 below.

Table 24: Summary of policies and legislation reviewed and indirectly relevant to mercury management in Antigua and Barbuda

Instrument	Relevance to Mercury Management
Stockholm Convention on Persistent Organic Pollutants (POPs) **Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and its Protocols**	The management of mercury and its compounds can be included in the management frameworks established under these Conventions to eliminate the use, release, import and export of POPs; for the environmentally sound management of POPs and stockpiles and wastes consisting of POPs; and for the prior informed consent procedure in the international trade of hazardous chemicals and pesticides.
National Policies	
Agricultural Land Use Policy	This policy focuses on new approaches to increase productivity and competitiveness, deepen linkages with other sectors, venture into new frontier areas as well as conserve and utilise natural resources on a sustainable basis. The potential use of mercury or mercury compounds in the manufacturing and production processes associated with emerging initiatives in agroforestry, biotechnology products and specialty natural products can have implications for mercury management.
Antigua and Barbuda Food and Nutrition Security Policy	Mechanisms for realising goals to achieve sustainable food and nutrition security and to ensure that all people in Antigua and Barbuda have continuous access to safe food may involve the introduction of programmes to improve the quality of food by reducing chemical content including pesticides and mercury.
National Water Resources Management Policy	The revised policy is expected to address the need for coordination and collaboration among the stakeholders, particularly regarding monitoring and enforcement of activities which may affect national water resources.
National Integrated Water Resources Management (IWRM) Vision Policy, 2009	Includes strategies for establishing a sustainable national capacity for water resources assessment and management and establishing and implementing effective wastewater management for urban and rural stakeholders to protect the terrestrial and marine aquatic environment.
National Legislation	
Pharmacy Act, No. 11 of 1995 (as amended by the Pharmacy (Amendment) Act, No. 9 of 2011	Establishes a Pharmacy Council to control and regulate *inter alia*, the sale of drugs and poisons. Mercury has been found to be an ingredient in some pharmaceutical products including antiseptics such as mercurochrome.
Precursor Chemicals Act, No. 10 of 2010	Regulates, supervises and monitors the importation, exportation, manufacture, sale, distribution, use and storage of precursor chemicals and any other chemicals capable of being used for the purpose of the illicit

	manufacture of controlled drugs or psychotropic substances, some which may contain mercury and its compounds.
Disaster Management Act, 2002	This Act gives responsibility to the National Office of Disaster Services (NODS) for managing emergencies and disasters, allows for the preparation of yearly National Disaster Preparedness Response Plans and provides powers relating to disaster management that can be utilised in responding to disasters and emergencies. The Act does not include a plan of action for wastes mobilised during a disaster event or for disasters that arise from pollution caused by the unsolicited discharge of chemicals including mercury.
Fisheries Act No. 22 of 2006	Ensures the quality and safety of fish and fishery products to be sold or offered for sale in or outside of Antigua and Barbuda. Consumption limits of aquatic species contaminated with mercury could be set through these Regulations.
Dumping at Sea Act Chapter 141	Prohibits any person from dumping substances or articles in Antiguan waters except in accordance with a licence. Mercury containing products should be included as a category of waste to be prohibited from being dumped at sea.
Environmental Levy Act, No. 22 of 2002 (Bottling and can levy)	Levy imposed on imported and manufactured goods set out in Parts I and II and collected by the Comptroller of Customs for payment to the Consolidated Fund for protecting and preserving the environment. Promotes the development of fiscal policy to encourage environmentally sustainable imports and local products with low waste or degradable waste content.
Physical Planning Act, No. 6 of 2003 Barbuda Land Act, 2007	Details regulatory approaches to: *inter alia*, ensure that sustainable use is made of land in the interests of all the people of Antigua and Barbuda; and maintain and improve the quality of the physical environment within which human settlements are situated in Antigua and Barbuda. The Act provides an opportunity for the establishment of regulations to control mercury and mercury compounds in sewage, effluents or waste from development and to consider chemicals management in development plans.
Burial Grounds Act Cap 61	Mercury can be released from corpses after burial. There are no regulations or procedures established under this Act which require licensed burial grounds to have linings that prevent the release of toxic components from corpses to the environment.
Petroleum Act Cap 326	Prohibits the import or export of petroleum except in accordance with the Act and governs the supervision of imports and storage conditions. Petroleum may contain trace amounts of mercury which may be released upon combustion. Appropriate steps should be taken to secure the importation of petroleum with lower mercury content and implement emission controls on combustion equipment.
Renewable Energy Act, No 6 of 2015	Establishes the framework for the development of renewable energy resources in Antigua and Barbuda. Antigua and Barbuda must carefully consider the impacts of potential mercury discharges from technologies and processes used in developing renewable energy resources.

The cursory examination of Antigua and Barbuda's policies and laws indicates that both are minimally developed, and mercury controls remain largely unaddressed.

The review concludes that there is no single policy document that deals with chemicals or mercury management, but instead, the task is conducted through a variety of policy instruments which when combined, do not establish a sufficient framework for effective management of mercury. Similarly, the management of chemicals is fragmented among several pieces of legislation on environmental management, trade, public health and other national concerns. Notwithstanding, a 2015 Environmental Management and Protection Act contains provisions that establish a broad, though weak, framework and oversight functions for chemicals management for the country.

Improving the national policies and legislation described in this Chapter can include developing a mechanism for ensuring collaboration between the various plans, with guidelines crafted on how to involve all relevant stakeholders. The technical infrastructures for analysing and monitoring chemicals must also be strengthened. Policies and legislation should be subjected to monitoring and evaluation to assess the extent to which they are being effectively implemented. Protocols for the various activities for the life cycle management of chemicals should be developed, adopted, and subject to regular review and revision.

The BCRC-Caribbean conducted a project GEF 5558 titled "Development and Implementation of a Sustainable Management Mechanism for Persistent Organic Pollutants (POPs) in eight (8) Caribbean Countries" which included a component on "Mainstreaming Sound Chemical Management into National Policy and Plans" for the development of a comprehensive chemicals regulatory framework in the participating Caribbean countries, including Antigua and Barbuda. A key output of the project was a Regional Model Integrated Chemicals Management Act. The model Act is founded on an assessment of the existing legislation and practices with respect to chemicals management in the participating countries, in order to identify cross-cutting issues which must be taken into account in developing an appropriate regulatory framework for chemicals management including mercury in the Caribbean region.

3.2 Existing Institutional Framework Related to Mercury Management

Responsibilities for waste and chemicals management and by extension, mercury management, in Antigua and Barbuda are shared among several governmental Ministries, Departments, Units and corporate statutory bodies that represent sectoral management systems for health, environment, land control and sustainable development. Various Boards, Councils, and Authorities also exist within different Ministries but having a cross-Ministerial/institutional composition. Private sector entities such as the Caribbean Agricultural and Research Development Institute (CARDI) also bear some responsibility in national chemicals management. No single entity has the mandate to address all chemically related functions within the governmental or private sector architecture.

Institutions with responsibility over waste and chemicals management relevant to mercury management are highlighted in Table 25 below.

Table 25: Description of relevant institutions with responsibility for mercury management in Antigua and Barbuda

Ministry/ Body/ Agency	Responsibilities	Relevance to Mercury Management
Ministries, Departments and Divisions		
Department of Analytical Services, Ministry of Agriculture, Land, Fisheries and Barbuda Affairs	The Department of Analytical Services comprises of two analytical laboratories located in Dunbars and Point Wharf which provide laboratory services to public and private sector agencies; has the capacity to analyse hazardous wastes and to conduct environmental monitoring; and aids the Bureau of Standards with the development of standards. This laboratory is in the process of seeking international accreditation. The Director of the Department of Analytical Services discharges responsibilities for, *inter alia*, chemical management and is the Competent Authority/ Focal Point for several MEAs in the waste and chemicals cluster.	The Department of Analytical Services has the capacity to analyse heavy metals, including mercury and could assist with the development of national standards related to mercury and its compounds. The Director of the Department of Analytical Services is the Competent Authority and Focal Point of the Minamata Convention and is responsible for the implementation of the Convention.
Department of Environment, Ministry of Health, Wellness and Environment	The Department of Environment has responsibility for national environmental management and the coordination of all environmentally related activities nationally including administering the Environmental Protection Management Act No. 11 of 2015. The Department is also responsible for granting pollution control permits, administering the requirements for environmental impact assessments for new waste infrastructure, and maintaining the national environment registry.	The Department of Environment, through the Environmental Protection Management Act No. 11 of 2015, may regulate and control the use and disposal of mercury and mercury containing wastes and regulate and monitor emissions and discharges of mercury and its compounds.
Customs and Excise Division	The Customs and Excise Division facilitates legitimate international trade and protects the borders from illicit trading activity. The Comptroller of Customs is responsible for the administration of the Customs (Control and Management) Act, 1993 and has powers to control the importation and conditions related thereto as well as their warehousing.	The Minister may amend the Third Schedule of the Customs (Control and Management) Act, 1993 at any time to prohibit items containing mercury from being imported, landed or unloaded in ANU. Once added to the Third Schedule, the Customs and Excise Division will be able to prohibit or restrict the entry or exit of listed mercury containing products.

Department of Labour, Ministry of Legal Affairs, Public Safety and Labour	Advises the Minister on matters relating to occupational safety and health and is responsible for promoting public awareness of occupational safety and health. The Department concerns itself with introducing measures for the protection of workers from the effects of chemicals on their health and well-being in an industrial environment.	The Department of Labour promotes compliance with occupational health and safety standards and may be charged with developing strategies to educate and prevent occupational and health-related exposure to mercury.
Barbuda Affairs	Governs the island of Barbuda. The Council has powers in the areas of, *inter alia*, administration of agriculture and forestry, public health and medical and sanitary facilities and services.	Responsible for implementing the Minamata Convention and mercury management activities in Barbuda.
Statutory Authorities/Bodies		
National Solid Waste Management Authority	The Authority, through the National Solid Waste Management Act, 1995, is responsible for conducting and/or overseeing operations dealing with the national management of wastes. NSWMA operates two landfill facilities (Cook Landfill and Plantation Landfill), is responsible for development of new sites, and prescribes fees for waste commercial waste loads disposed to Cooks Landfill. NSWMA also serves to enforce the Litter Management Act through the appointment of litter wardens.	NSWMA may recommend regulations or guidelines for the reduction and/or management of mercury containing products and wastes which are listed in the National Solid Waste Management Authority Act as hazardous wastes.
Pesticides and Toxic Chemicals Control Board (PTCCB)	Ensures that all pesticides and toxic chemicals manufactured, stored, distributed, and sold in Antigua and Barbuda adhere to and maintain international, product standards in compliance with public health regulations. Powers of inspection, entry, examination, seizure and investigation are vested in inspectors in order that they discharge their duties under the Pesticides and Toxic Chemicals Act. PTCCB determines applications for registration, licences and research permits for pesticides and toxic chemicals, and advises the Minister on the making of regulations. Registrar is responsible for keeping and maintaining registers of licences, pesticides and toxic chemicals.	The PTCCB may provide recommendations to the Minister of Agriculture regarding the addition of mercury-added pesticides and chemicals to the list of prohibited and controlled products through the Pesticides and Toxic Chemicals Act, and the creation of regulations related to mercury and its compounds.

Central Board of Health	Mandated to take all steps as may be desirable to secure the preparation, effectual carrying out, and coordination of measures conducive to public health; and to make recommendations as to the prevention of diseases and the preservation of public health in Antigua and Barbuda. Regulates nuisances and offensive trades under the Public Health Act and Litter Control and Prevention Act.	Administers the Litter Control and Prevention Act which may have implications for the management of waste mercury containing products, and the Public Health Act.
Antigua Public Utilities Authority	Water resources management is vested in the APUA as the implementing authority for the Public Utilities Act No. 10 of 1973.	The Authority could establish mechanisms to monitor and regulate mercury content in water supplies and sewage and wastewater discharges.
Antigua and Barbuda Ports Authority	It is the function of the Authority, *inter alia*, to develop the harbours of Antigua and Barbuda, to operate port services, and to determine the conditions under which goods shall be carried.	The Authority may determine conditions upon which goods, such as mercury and mercury-added products, shall be carried or warehoused.
Antigua and Barbuda Bureau of Standards	Responsible for the promotion and promulgation of standards and standards related matters that are relevant to the sustainable development of the nation's economy.	The Bureau of Standard's role in quality assurance and metrology provide an important role in informing consumers and protecting them against chemicals such as mercury that may present a threat to human safety.

Other indirectly related ministries, agencies and regional bodies include:

• Department of Analytical Services, Ministry of Agriculture Land, Fisheries and Barbuda Affairs	Conducts all chemical analytical work on behalf of the State as well as analysis of water samples. The lab is responsible for ensuring that all chemicals are properly stored and disposed of in accordance with established standards always being cognizant of the grave health risks that exposure to certain chemicals can pose, and ensures that dangerous and harmful chemicals are only procured in manageable quantities considering the risks and benefits of using the chemicals.
• Fisheries Division, Ministry of Agriculture, Land, Fisheries and Barbuda Affairs	The main body responsible for coastal resources. Activities include data collection and analysis, quality assurance and control, public awareness and training, conservation and environmental monitoring with a focus on coastal and marine biodiversity, and surveillance and control of the waters of Antigua and Barbuda. There is concern over the consumption of fish containing mercury which falls to the Fisheries Division to address through collaboration with other entities.
• Environmental Health Department, Ministry of Health, Wellness and Environment	Responsible for monitoring the quality of potable water and coastal waters and among other things, enforcement of environmental sanitation regulations. Samples are taken on a weekly basis from source and on a daily basis from the distribution system and sent to the laboratory in the Ministry of Agriculture. Samples are not tested for mercury concentrations.
• National Office of Disaster Services (NODS), Ministry of Social Transformation and Human Development	Responsible for reducing the vulnerability of natural and technological hazards through multi-sector and integrated hazard risk reduction management. NODS, through its operations, seeks at all times to save life and protect property in Antigua and Barbuda. NODS assists in the planning and execution of comprehensive stakeholder disaster management exercises at the national level. This is done to test the effectiveness of existing plans and identify deficiencies that need to be addressed by various agencies.
• Ministry of Foreign Affairs, International Trade and Immigration	Responsibilities as regards international trade are of relevance to the implementation of the Minamata Convention as regards the establishment of measures to control the importation of products containing mercury into the country.
• Ministry of Education, Science and Technology	Responsible for increasing awareness and appreciation of the natural environment as well as promoting an understanding of the role of science and technology in society together with scientific and technological skills. The Minamata Convention requires the adoption of waste management technologies that are not yet in place in Antigua and Barbuda. The Ministry is therefore a relevant partner to give effect to this aspect of the Convention.
• Pharmacy Council	Established under the Pharmacy Act, 1995 and vested with multiple responsibilities including (a) deciding on matters relating to the registration of persons as authorised importers, exporters, manufacturers or sellers of pharmaceutical products; (b) to advise the Minister on matters relating to registration of premises and persons authorised to sell drugs and poisons; and (c) to give directions to the Registrar in the performance of his duties under this Act. For the purposes of the Act, there shall be

	a Registrar who is appointed by the Minister on the advice of the Council. The Minister may make regulations *inter alia*, for specifying the substances that are poisons for the purposes of this Act.
• Development Control Authority	Established under the Physical Planning Act, 2003 and has responsibility for administration and execution of land use planning and development control as set out in the Act. In Antigua and Barbuda, land use planning is administered using two divisions within the National Physical Planning Office, namely: (i) a Development Control Division or Unit dealing mainly with development, applications, review, assessment of impacts, granting of permits, and enforcing the terms of the permit; and (ii) a Unit expected to focus on "long-term" or "forward" planning, including research, plan preparation, policy formulation and collaboration with economic planning on matters of development policies and strategies.
• Environmental Awareness Group (EAG)	NGO involved with environmental advocacy, public education and awareness, research on plants, wildlife and ecosystems, and trail building. EAG also collaborates with the Mount Obama Committee (MOC) created by the Government of Antigua and Barbuda to coordinate planning leading to the creation of the Mount Obama National Park (MONP) whose objectives for management include conservation of biodiversity, soil and water conservation and protection of critical forested areas. More recently, the EAG has become involved in efforts to improve community management of coastal natural resources, providing training to stakeholders in practices that conserve reefs, off-shore island ecosystems and mangrove wetlands. The EAG has consistently raised issues of sustainable natural resource management.
• Antigua and Barbuda Waste Recycling Corporation (ABWREC)	Established in 2005 with goals of reducing the amount of plastic and aluminium beverage containers entering the environment. The organisation, in its sorting operations, may encounter products containing mercury and should therefore become equipped to comply with the storage requirements established in Annex A and D of the Minamata Convention.

The Department of Environment is vested with oversight capability for chemicals management in Antigua and Barbuda. This oversight function is wide-ranging and is in respect of entities responsible for the Pesticides and Toxic Chemicals Control Board, Ministry of Agriculture, Lands, Fisheries and Barbuda Affairs and the national Solid Waste Management Authority. This governance arrangement could prove valuable for the establishment of a coordinating function for the management of chemicals including mercury in Antigua and Barbuda. The Department of Analytical Services is the entity responsible for the implementation of compliance activities under the Minamata Convention.

Institutions are divided across diverse Ministries and other governmental bodies based upon the relevant laws enacted. Chemicals are placed within the remit of institutions based on the purpose of the chemicals as used within the sector being regulated under the law. In light of this, the institutional framework lacks a holistic regulatory approach by which all chemicals are subject to a central institution. This creates avenues for conflicts and differing functions and powers. As a result, decision-making is hampered by differing priorities across institutions for chemical management.

Scarce human, material and financial resources limit efforts to effectively implement, monitor and enforce existing laws and regulations and improve national environmental and chemicals management. Limited staff are assigned to effectively manage these sectors. Relevant legislations, including the Pesticides and Toxic Chemicals Control Act, the Environmental Protection and Management Act and the Public Health Act, account for the appointment of officials to aid in monitoring and enforcement; however, the provisions under these legislations are broad and do not specify standards, permissible limits or guidelines which should be followed, therefore limiting the effectiveness of appointed officers. Additionally, national allocation of funds for environmental protection are significantly lower than that in other sectors.

3.3 Recommendations for Governance Framework for Mercury Management and Implementation of the Minamata Convention on Mercury

3.3.1 Reform of Existing Governance Framework for Mercury Management

As a general observation, it may be concluded that the chemicals management framework in Antigua and Barbuda does not specifically include mercury; however, it is identified as hazardous in some legislation and noted as a chemical that should be controlled. The governance framework is fragmented, sometimes dated, and roles and differing responsibilities are distributed among the several institutions that are vested with them.

Specifically, no policy that is of direct relevance to chemicals management exists, although policies for solid waste, agriculture, environment, water, and physical planning provide the raison d'etre for the establishment of chemicals management activities. The review may conclude that as a major weakness, cumulatively they lack comprehensiveness. The need is therefore for a chemicals management policy that establishes comprehensive strategies on mercury risks by outlining what Antigua and Barbuda hopes to achieve under its chemicals management structure and clarifying the methods and principles that it will use to achieve them.

The elemental architecture for chemicals management is scattered in several laws and institutions in Antigua and Barbuda.

The country has been a beneficiary to another BCRC-Caribbean project for the implementation of the Stockholm Convention on Persistent Pollutants (Stockholm Convention). The project has produced a Regional Model Integrated Chemicals Management Act as a framework that integrates existing and required laws under this single instrument for the implementation of the three chemicals MEAs as well as the Minamata Convention.

The NWG examined the Regional Model Integrated Chemicals Management Act and in so doing embraced the model Act as providing an overarching framework for the management of chemicals in Antigua and Barbuda. However, the NWG also agreed that it was requisite that several aspects of the model Act were in need of reform to make it suitable for the implementation of the Minamata Convention in Antigua and Barbuda. Thus, the NWG has put forward the following recommendations:

I. Establish a legal framework for the management of chemicals that:

- Consolidates primarily the Regional Model Integrated Chemicals Management Act with the Pesticides and Toxic Chemicals Act, Standards Bill and National Solid Waste Management Act and other related laws;
- Takes into account the role of the National Implementing Committee established under the Environmental Protection Act, 2013;
- Makes provision for a Chemicals Management Authority that is governed by a Board comprising the competencies currently identified within the Pesticides and Toxic Chemicals Act such as Customs and Excise Division, Public Health, Solid Waste Management Authority and the Bureau of Standards. The Authority will be responsible for the management of all chemicals in Antigua and Barbuda; and
- Makes such other amendments to the Regional Model Integrated Chemicals Management Act appropriate to Antigua and Barbuda which as a consequence repeals the Pesticides and Toxic Chemicals Act, saving certain aspects for consideration in the model Act. The Precursor Chemicals Act will also be repealed.

II. Establish the Analytical Laboratory Services in a separate legislative instrument.

The Ministry of Agriculture Lands, Fisheries, and Barbuda Affairs will be the sponsor of the Regional Model Integrated Chemicals Management Act. The Ministry has signalled data collection to be fundamental to effective implementation of a chemicals management framework not only in Antigua and Barbuda but also the OECS region. In this regard the Ministry has recommended follow up action to:

- Establish a *Caribbean Data Collection and Monitoring Network (in cooperation with BCRC-Caribbean)* that stores original raw data and integrates other data collection systems as far as possible among other things.

The country is a Party to other chemicals related MEAs including the Basel Convention, the Stockholm Convention, the Rotterdam Convention (chemicals cluster MEAs), and the Cartagena Protocol. Through its participation in the MIA Project, Antigua and Barbuda has an opportunity to strengthen its existing legal, policy, and institutional arrangements for the management of chemicals by establishing a framework that consolidates the implementation of the chemicals cluster MEAs alongside the Minamata Convention to thereby establish an efficient and

effective comprehensive chemicals management framework.

Additional recommendations include:

- Include recordkeeping, registration, and permitting arrangements in the legal framework governing all chemical management instruments.
- Provide information to the public on the legislative and institutional framework related to mercury management in order to increase compliance.
- Promote public awareness on measures for the prevention, treatment and care of persons affected by exposure to mercury or mercury compounds with the participation of public health and other involved sectors.
- Establish special educational activities to strengthen the capacities of healthcare professionals who will be responsible for administering care in the prevention, diagnosis, treatment and monitoring of health risks related to exposure to mercury and mercury compounds.
- Develop and implement science-based educational and preventive programmes on occupational exposure to mercury and mercury compounds.
- Promote collaboration with the WHO, the International Labour Organisation and other relevant intergovernmental organisations, to exchange information and achieve guidance on risks related to mercury exposure and other technical aspects of chemicals management.

3.3.2 Implementation of the Minamata Convention on Mercury

The Minamata Convention addresses specific human activities which are contributing to widespread mercury pollution and requires Parties to reduce the use or emission of mercury within their jurisdictions. Parties must have in place or establish a policy, legal and institutional framework that gives effect to the Convention's requirements. The Articles of the Minamata Convention establish the requirements and implementing framework for the effective management of mercury.

Based on the inventory of mercury releases conducted and the mercury issues relevant to Antigua and Barbuda determined in Chapter 2 of this report, the following articles of the Minamata Convention are most relevant for Antigua and Barbuda:

- Article 4- Mercury-Added Products
- Article 8- Emissions
- Article 9- Releases
- Article 11- Mercury Wastes
- Article 12- Contaminated Sites
- Article 16- Health Aspects
- Article 17- Information Exchange
- Article 18- Public Information, Awareness and Education
- Article 19- Research, Development and Monitoring.

Table 26 sets out the gaps in the governance framework for mercury management in Antigua and Barbuda and lists suggestions for reform to comply with the relevant obligations set forth in the Convention.

Table 26: Inventory of Gaps in the Governance Framework and Suggestions for Reform

Convention Article	Existing Gaps	Suggestions for Reform	Responsible Agencies
Article 4 Parties to disallow the manufacture, import and export of mercury containing products listed in Part I of Annex A by 2020. Parties shall implement measures to phase down the use of dental amalgam, which is listed in Part II of Annex A.	Production of mercury containing products does not occur in ANU. There are existing gaps in the inventory of imported mercury-added products conducted under the MIA Project due to data collection and monitoring limitations. The status of the export of mercury-added products from the country is unknown. No legislation in place to support the restriction or ban of the importation of mercury containing products listed in Part I of Annex A by 2020.	Relevant agencies should determine the feasibility of banning mercury-added products listed by the Convention and develop phase-out plans for mercury-added products. Through the Standards Bill, 2017, the Bureau of Standards may develop standards for mercury-added consumer products. Under the Customs (Control and Management) Act, 2013, the Comptroller of Customs may prohibit the import of specified mercury-added products. The import of pesticides and chemicals containing mercury may be regulated through the Pesticides and Toxic Chemicals Act through addition to the list of items regulated by the Pesticides and Toxic Chemicals Control Board. Mercury containing pharmaceuticals and precursor chemicals may also be regulated under the relevant Acts.	Department of Analytical Services ANU Bureau of Standards Customs and Excise Department Pesticides and Toxic Chemicals Control Board Ministry of Health, Wellness and Environment
Article 8 Parties (where feasible) shall take measures to control emissions of mercury and mercury compounds from the most significant point sources identified in Annex D for new and existing sources, including waste incineration.	A National Plan setting out measures to control emissions containing mercury including the type of measures required to be implemented to control emissions is not yet in place.	Measures must be taken to control mercury emissions from waste incineration facilities including application of best available techniques (BAT) and best environmental practices (BEP) within five years. Options for control measures for existing sources must be guided by national circumstances and economic and technical capacities and taken within 10 years. Relevant laws through which these provisions may be enacted include the National Environmental Management Strategy (NEMS) and Action Plan, Environmental Protection and Management Act No. 11 of 2015, National Solid Waste Management Authority Act, and Public Health Act Cap No. 353 of 1957 (as amended).	Department of Analytical Services Department of Environment National Solid Waste Management Authority Ministry of Health, Wellness and Environment

Article 9 Parties to identify relevant point sources of mercury and, where feasible, to take measures to control releases to land and water.	Relevant legislation to regulate the releases of mercury and its compounds to land and water are not enacted or enforced. The Antigua Public Utilities Act does not make provisions for mercury. Although the Public Health Act considers pollution, it does not provide coverage for mercury.	Enact provisions to regulate releases of mercury to water under the Antigua Public Utilities Act 1973. Consideration should be given to strengthen the Environmental Protection and Management Act with provisions to regulate and monitor releases of mercury and its compounds to land and water, to enact the polluter pays principle to prevent the discharge of mercury and its compounds from identified point sources.	APUA Department of Environment Ministry of Health, Wellness and the Environment Department of Analytical Services
Article 11 Parties to ensure that mercury wastes (substances consisting, containing or contaminated with mercury or mercury compounds) are: • Managed in an environmentally sound manner (ESM); and • Only recovered, recycled, reclaimed or directly reused for a use allowed to a Party under the Minamata Convention for ESM disposal.	A comprehensive policy and legislative framework for the management of mercury wastes is not in place. ANU has not yet enacted national implementing legislation for the Minamata Convention or the Basel Convention which includes wastes with constituents of mercury and mercury compounds as hazardous. Wastes containing mercury are dumped indiscriminately or taken to the landfills where they are primarily disposed of by burial.	The National Environmental Management Strategy and Action Plan (2004-2009) should be updated to include a strategy for managing hazardous wastes such as mercury. Consideration should also be given to include wastes containing mercury in the Draft National Solid Waste Management Authority Strategic Plan (2014-2029) before enacting the Plan. Regulations and guidelines (based on BAT/BEP) for the management and disposal of mercury containing products and wastes should be added under the National Solid Waste Management Authority Act. Implementing legislation for the Minamata and Basel Conventions should be enacted through the Environmental Protection and Management Act to establish procedures for notification, prior informed consent, tracking of movements, and environmentally sound management of hazardous wastes including mercury wastes. Mechanisms to support the private sector in strengthening existing systems for mercury recovery and final disposal, and to strengthen the enforcement of guidelines for recovery, reuse, recycling and disposal of mercury-added products should also be addressed in this Act. Regulations should be developed under the Litter Control and Prevention Act to support appointed officers with the issuance of penalty notices for dumped wastes including mercury-added products.	Department of Environment National Solid Waste Management Authority Central Board of Health Department of Analytical Services

Article 12 Parties to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds.	Landfill sites and informal dumpsites may be contaminated by mercury from the disposal of mercury-added products. Other sites contaminated by mercury or mercury compounds have not been identified. Adequate provisions for the identification, assessment and management of mercury contaminated sites are lacking.	ANU should establish programmes to identify, assess, remediate and manage risks associated with contaminated sites, including sites contaminated by mercury or its compounds. Provisions for the remediation of contaminated sites other than waste management facilities should be included under the National Waste Management Authority Act. Other relevant legislation include the Environmental Protection and Management Act, Litter Control and Prevention Act (appointed officers could assist with identification of dump sites) and Public Health Act.	Department of Analytical Services Department of Environment National Solid Waste Management Authority Central Board of Health Ministry of Health, Wellness and Environment
Article 16 Encourages Parties to establish institutional and health professional capacities for monitoring of health risks related to exposure to mercury and mercury compounds.	Provisions in existing laws to manage risks associated with mercury exposure need to be reviewed.	The Central Board of Health, through the Public Health Act, may take measures to manage health risks related to mercury exposure including monitoring of persons living close to potentially mercury contaminated sites. Monitoring of the health risks of workers in fields in which mercury exposure is possible should be implemented through the Occupational Health and Safety Act. Technical capacities for testing and analysis should be strengthened. The capacities of health workers should be strengthened through training and awareness raising to aid in the prevention, diagnosis, treatment and monitoring of health risks related to exposure to mercury and mercury compounds.	Central Board of Health Department of Labour Ministry of Health, Wellness and Environment Department of Analytical Services National Solid Waste Management Authority
Article 17 Requires Parties to facilitate exchange of a wide range of information.	The Department of Analytical Serves, as the focal point for the Minamata Convention, is responsible for coordinating the collection of national information and facilitating the exchange of information to the Secretariat and other relevant organisations. However, provisions mandating or promoting the collection and	The legal framework governing all chemical management instruments should be strengthened to include recordkeeping, registration, and permitting arrangements. Information collection could be facilitated through provisions of relevant Acts and compiled and transmitted to the Department of Analytical Services by responsible agencies.	Department of Analytical Services All stakeholder agencies

	exchange of information is lacking. There is limited human, technical and financial resources to facilitate the collection of relevant information.		
Article 18 Encourages Parties to promote and facilitate public information, awareness and education.	Public awareness raising material are being developed under the MIA Project. Additional national information, awareness raising and educational tools that guide the public on the harmful effects of mercury on human health and the environment should be developed and disseminated.	All governmental entities that discharge responsibilities for waste and chemicals management should collaborate to prepare programmes to facilitate the dissemination of developed awareness raising material. The Department of Analytical Services should coordinate these efforts. Academic institutions, NGOs, civil society organisations (CSOs) and the private sector should also become involved to provide guidance in the development and implementation of a comprehensive awareness raising strategy.	Department of Analytical Services All stakeholder agencies
Article 19 Encourages Parties to endeavour to cooperate to develop methods to for research monitoring and development.	Under the MIA project, considerations for the identification of potential hotspots of mercury in Antigua and Barbuda have been developed. Antigua and Barbuda also participated in activities related to the testing for mercury concentrations in cosmetics under the project as well as of fish and human hair under the respective projects, “Fish Mercury Biomonitoring in The Caribbean Region” and “Global Mercury Hair Monitoring in Women of Child-Bearing Age in Small Island Developing States (SIDS) Pilot Project”. Efforts for regular monitoring of mercury levels is needed.	Strengthen institutional capacity and facilities to establish certified and regular monitoring activities.	Department of Analytical Services Ministry of Health, Wellness and Environment Central Board of Health Fisheries Division

Chapter 4: Identification of Populations at Risk and Gender Dimensions

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

Mercury has the ability to travel long distances in the atmosphere, persist in the environment, accumulate in ecosystems and significantly adversely affect human health and the environment and as such, has caused major concerns worldwide. Exposure to mercury can be chronic through long term contact or acute over a brief period of time at high dosage (World Health Organisation, 2017). Extensive exposure disrupts the central nervous system which causes tremor, insomnia and memory impairments. Whereas, acute exposure aligns with symptoms such as nausea, abdominal pain, bloody diarrhea, kidney damage or even death (Shirkhanloo et al., 2014).

Although mercury is dangerous to all humans, there are groups that are more sensitive to the health effects and factors that determine the severity of the effects. These factors include:

- Form of mercury (methylmercury is more toxic to humans);
- Amount of mercury;
- Age of person exposed;
- Duration of exposure;
- Route of exposure; and
- Dietary patterns of fish consumption (UNEP/WHO, 2008).

Women of childbearing age; pregnant women; fetuses; newborns; and young children (less than 12 years of age) are included in the groups that are more sensitive to the effect. Fetuses and children are at highest risk when exposed to mercury because their nervous systems are still developing. Studies have shown that the concentration of mercury within a fetus is higher than that of the mother due to active transport of the mercury through the placenta (UNEP/WHO, 2008). Newborns and young children (under the age of 5) are susceptible to the effects of mercury as their nervous systems and organs are still developing (“Growth and Development of Children”, n.d.).

Populations or groups with continuous exposure to high levels of mercury are also more susceptible to the health impacts from mercury. These groups typically include persons with diets featuring significant amounts of fish, especially in fishing coastal communities, and those exposed through occupational roles, such as engaging in waste management activities, healthcare workers, dental personnel and certain industrial workers. A preliminary risk assessment of populations at risk is shown in Table 27.

Article 16 of the Minamata Convention encourages Parties to develop strategies and programmes to identify these sensitive groups and populations at risk to adopt science-based health guidelines and targets to reduce the negative health impacts of mercury exposure, and to increase the capacity of health-care systems to be able to better monitor, prevent and treat affected populations.

Table 27: Preliminary risk assessment of populations at risk due to sensitivity to mercury (UNEP/WHO, 2008)

POPULATION	DESCRIPTION	RISK LEVEL
Pregnant women and fetuses	Methyl mercury concentrations in fetuses' blood are 1.5 to 2 times higher than his/her mother. This high rate is due to the "active transport of methylmercury to the fetus through the placenta". Fetuses are especially at risk to high mercury levels as their developing nervous systems are very sensitive. Women of childbearing age who are planning to have a child should also be warned of this risk.	High
Nursing women and infant children	Mercury levels within nursing women's blood stream can be transferred to infants via breast feeding. Risks are high due to the child's developing central nervous system.	High
Persons with certain illnesses	Persons with diseases of the liver, kidney, nerves and lungs, as well as those who suffer from undernutrition (especially lack of zinc, glutathione, antioxidants, or selenium) and malnutrition are vulnerable to unsafe levels of mercury as their bodies are ill-equipped to protect itself against it.	High to Moderate
Older children and adolescents	Research has shown that although the risk levels are lower, children up to the age of 17 are more at risk to harmful mercury effects when compared to adults. Again, this is due to the fact that the human central nervous system develops from birth to adolescence.	Moderate to Low

4.1.1 Mercury exposure to humans through seafood

Antigua and Barbuda is a small island developing state (SIDS) and the country's population is concentrated along the coasts. Fish is a staple in the diet of Antiguans, and more-so for Barbudans since the island is relatively small and fish is a primary choice of meat.

The consumption of fish provides numerous health benefits, such as the provision of important nutrients like Omega-3 for healthy growth and development. However, with the presence of mercury in different waterbody hotspots, methylmercury can be formed and can biomagnify and bioaccumulate in aquatic food webs, potentially contaminating an important food source for the population. Predatory fish and large fish species with longer lifespans tend to contain elevated levels of mercury and therefore extensive consumption of these species can increase the mercury levels and affect the human health.

There are many studies on the impact of methylmercury toxicity to the neurological, cardiovascular, and immune systems within humans. For example, neurological impacts are often measured and become evident through lowered IQ levels (Spadaro and Rabl, 2008) and through various neuropsychological tests (Grandjean et al., 1998). Cardiovascular and immunological impacts are often related to chronic exposure to mercury (Sweet and Zelikoff, 2001; Downer et al., 2017). The relative impacts from methylmercury's toxic effects can vary across human populations as some groups are more sensitive to the impacts of exposure. Methylmercury is known to affect neurological development in children and is also linked to cardiovascular disease

in adults (Clarkson et al., 2003; Valera et al., 2011; Grandjean et al., 2012).

Since fish and other seafood are regularly eaten by populations in Antigua and Barbuda, groups in this country have a higher risk of exposure to mercury through the frequent consumption of aquatic species with bioaccumulated mercury. Health based organisations such as the WHO, the United States Environmental Protection Agency (U.S. EPA) and the European Commission (EC) have examined fish mercury concentrations to identify the types of fish that are likely to have higher mercury content, and to develop consumption guidelines which indicate the number of seafood meals that could be eaten to stay within recommended doses.

Table 28 shows guidelines for the safe consumption of seafood containing mercury that were created based on the U.S. EPA reference dose of $1x10^{4}$ mg of Hg/kg of body weight/day, a body weight of 132 pounds (60 kg) for an adult female person, and a fish meal size of about 6 ounces (170 grams). These guidelines are for muscle tissues in fish as >95% of Hg is in the methyl form, and therefore this consumption guidance cannot be directly used with the shellfish total mercury data.

Table 28: US EPA guidance for seafood consumption based on mercury concentrations

Mercury in Seafood (ppm, ww)	Consumption Guidance
≤ 0.05	Unrestricted
0.05 - 0.11	2 meals per week
0.11 - 0.22	1 meal per week
0.22 - 0.95	1 meal per month
> 0.95	No consumption

For further reference, the WHO and the EC general guidance level for fish mercury concentrations is 0.5 ppm with an "exemption" for larger, predatory fish species of up to 1.0 ppm, which is similar to the U.S. EPA "no consumption" level.

In 2018, a rapid assessment of mercury in fish concentrations was conducted by BRI in collaboration with the Swiss-funded UNIDO project, "Fish Mercury Biomonitoring in the Caribbean Region". According to the rapid analysis, it was found that some regularly and commercially harvested seafood from Antigua and Barbuda can be safely consumed either on a daily or weekly basis, as they may have average mercury concentrations under 0.22 ppm, ww. Coney, Red Snapper and other small individuals may be among these species. On the other hand, mercury concentrations (BRI, 2019) may be higher in large pelagic, predatory and long-lived species like the Blue Marlin and Great Barracuda. Mean mercury levels in these larger species may exceed 0.22 ppm, and it is recommended that human consumption be limited to only one meal per month as they are riskier choices. Fish and seafood with Hg concentrations over 0.95 ppm, ww should not be consumed regularly in Antigua and Barbuda.

The monitoring of mercury in fish and seafood in Antigua and Barbuda needs to be improved to ensure accurate exposure estimates over time, and to inform advisories on healthy dietary practices throughout the country.

4.1.2 Occupational and environmental exposure to mercury

Individuals are often unaware of the possible exposure to mercury and mercury compounds in their everyday, occupational or environmental surroundings. The International Labour Organisation reports that 22 percent of workplace fatalities and work-related diseases worldwide are due to improper handling of chemicals and

other hazardous substances (Global Employment Trends, 2004). Population groups that have an increased frequency of exposure are at greater risk to the effects of mercury. Table 29 below provides an assessment of the populations who are exposed to higher levels of mercury and their risk level.

Table 29: Preliminary risk assessment of populations at risk due to high/higher mercury exposure

POPULATION	DESCRIPTION	RISK LEVEL
Fishing communities	Persons who frequently consume fish, especially larger predator species, are more at risk to mercury contamination. The level of risk can vary and is dependent on how much fish is consumed, the type of fish consumed and the fish's level of mercury contamination. Fishing villages in Antigua and Barbuda have easier access to fish, and populations are assumed to consume more fish than the average person. Commonly consumed fish of concern include Blue Marlin and Yellow Fin Tuna. Based on research done by the Biodiversity Research Institute (2018), mercury levels in these two species are in excess of the recommended mercury consumption guidelines set by The Great Lakes Commission (GLC) of the Great lakes Fish Advisory Workgroup and WHO and they should not be frequently consumed.	High to Moderate
Pescatarians	Pescatarians, people who do not eat any meat other than fish, are also at high to moderate risk of experiencing adverse mercury health effects due to the frequent consumption of potentially mercury-contaminated aquatic species. Some religious groups are known to be either strictly or largely pescatarian. In Antigua and Barbuda, two such groups are Rastafarians and Seventh-Day Adventists.	High to Moderate
Environmental/ enforcement officers	MAPs enter the landfill through general and medical waste streams. Mercury exposure from this occupation can occur if broken bulbs and other damaged mercury-added products are included in wastes being handled. Training on environmentally sound management of MAPs, upkeep of the machinery and the use of proper safety equipment will reduce the risk of workers being exposed to harmful levels of mercury from the disposal of MAPs. However, without these measures, a moderate risk level stand.	Moderate
Medical and laboratory workers	Some medical and laboratory equipment such as blood pressure gauges and thermometers contain mercury. Exposure to mercury may occur during breakage and subsequent disposal of mercury containing equipment. The risk of exposure in this manner has been determined to be moderate as breakage may not be a common occurrence. Public awareness on the hazards of mercury exposure and proper disposal procedures are not prevalent in Antigua and Barbuda.	Moderate
Persons who use large quantities of cosmetics which contain mercury	Some cosmetic products are known to contain low to high amounts of inorganic mercury or organic mercury. Mercury in its inorganic form is used for its skin bleaching properties in products such as skin lightening and anti-aging creams. Mercury is known to "inhibit the formation of melanin, the pigment that gives human skin a dark colour" (BRI, 2018).	Moderate

POPULATION	DESCRIPTION	RISK LEVEL
	Such use of mercury is often illegal; and where industries are unregulated, dangerous levels of mercury may be used in the creams. Constant exposure to mercury in cosmetic products can lead to mercury poisoning. The level of risk is identified to be moderate as cosmetic products, which contain very high levels of mercury are not known to be dominant in Antigua and Barbuda.	
Persons with dental amalgam	Dental amalgam, used to fill tooth cavities, is made of a combination of mercury, silver, tin and copper. According to UNEP and WHO (2008), persons with dental amalgam fillings have been found to have higher levels of mercury in their bodies when compared to those who do not have dental amalgam fillings. This is due to the inhalation of and/ or ingestion of elemental mercury releases from the fillings. Therefore, the associated risk is considered to be moderate to low.	Moderate to Low
Dental practitioners	Dental practitioners who utilise dental amalgam are exposed to low levels of mercury via inhalation of elemental mercury from the amalgam during mixing and installation. Consultation with the Ministry of Health and Social Services: Dental Department and private dentists revealed that adequate safety measures are used to provide protection.	Low

Training on the risks of mercury exposure and personal protective equipment should be required by all workers in the fields highlighted in Table 29. Best environmental practices (BEP) and best available techniques (BAT) should be identified and promoted to ensure that professionals in Antigua and Barbuda use environmentally sound clean-up methods when handling broken mercury containing items. Source separation of mercury wastes should also be promoted in order to reduce the quantities of this waste stream entering the landfills and to decrease the risk of exposure by waste handlers.

People living close to areas which are sensitive to mercury contamination are also at an increased risk to the adverse health effects caused by mercury exposure. These higher risk areas are typically around hot spots and point sources of uncontrolled mercury release such as the Cooks Landfill and the Burma dumpsite in Antigua, the Plantation Landfill in Barbuda and illegal dumpsites throughout the country. Measures should be put in place for the control of mercury releases at these sites to prevent emissions to the environment and decrease the risk to nearby residents.

4.2 Assessment of Potential Gender Dimensions related to the management of mercury

Gender equality is an integral part of the implementation of the Minamata Convention as it is important to represent equality of the experience and realities of all members of society. The United Nations Economic and Social Council (UN ECOSCO) has defined 'gender mainstreaming' as "a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of the policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated" (UNDP, 2007). It is recommended that gender mainstreaming considerations be

incorporated into national activities for the implementation of the Minamata Convention in Antigua and Barbuda and also for activities related to achieving the United Nations Sustainable Development Goals. Under the MIA Project, a rapid gender analysis was conducted by Ms. Candice Ramessar, Gender Consultant. The findings of the analysis are presented in this Chapter and Chapter 6 of the report.

Gender difference in occupational roles, household roles and cultural practices can affect the level of mercury exposure to men and women and furthermore, toxic chemicals can affect men and women differently due to their varying biological factors. Chemicals can also affect men and women at different stages of their life and women especially tend to have time periods during which they are more vulnerable to the exposure to chemicals and consequently this exposure can result in serious consequences for their babies. Chemicals transferred during fetal development can cause lifelong harm.

4.2.1 Occupational Exposure

In SIDS, it is common to have certain occupational roles and tasks that may be more oriented towards men and vice versa and depending on these occupational roles and social circumstance, there are gender differences towards greater risk of exposure to toxic chemicals, including mercury.

According to the data from the Antigua and Barbuda Statistics Division in 2015, male participation in the labour force was 73.9%, while female participation was 68.5%. Figure 6 shows the gender differentiation in various sectors which could pose a risk to occupational exposure to mercury in 2015.

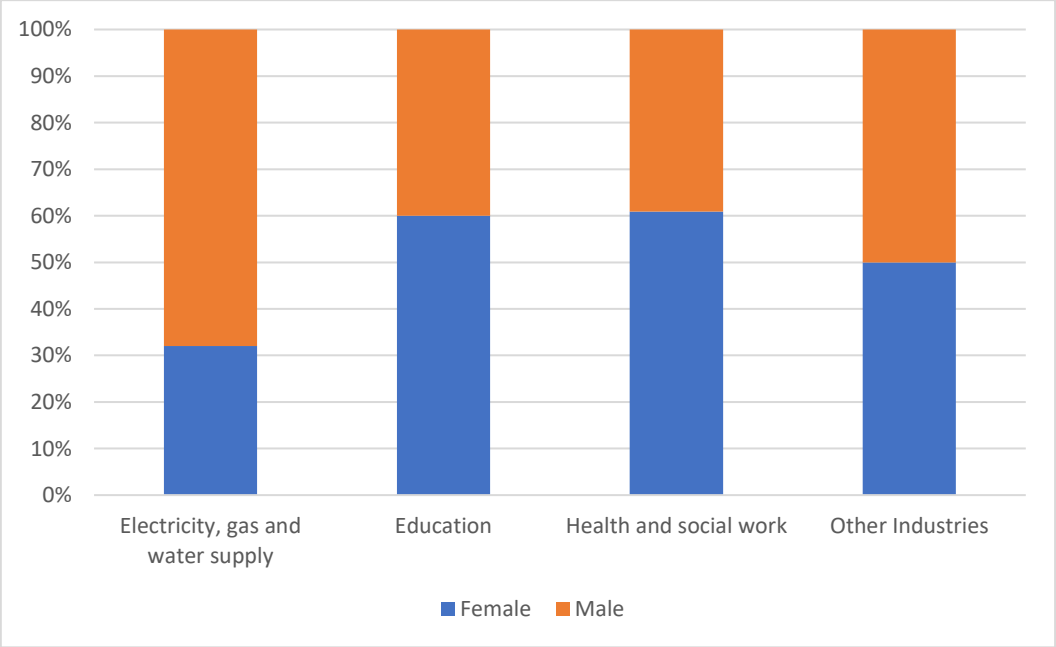

Figure 6: Distribution of sectors potentially exposing workers to mercury in 2015 by gender (Source: Antigua and Barbuda Statistics Division, 2015) Note: Other industries include mining and quarrying, extraterritorial and bodies as well as industries not stated.

Males dominate occupations within electricity, gas and water supply as well as the quarrying and mining industries. Similarly, males dominate the waste sector in Antigua and Barbuda. Workers within NSWMA that are potentially exposed to mercury include the Landfill Department Staff (landfill technicians, operators,

supervisor labourers, equipment washers and security personnel) and Collections Department Staff (Loaders and drivers). According to NSWMA, approximately 92% males fall under the Landfill Department Staff, while 96% males dominate the Collections Department Staff.

In contrast, females dominate both the health and education sectors. The workers within these sectors may include teachers, lab technicians, doctors, nurses, dentist and dental assistants. According to the Statistics Division (2015) and the Antigua and Barbuda Recurrent and Development Estimates (Government of Antigua and Barbuda, 2018), more females are employed within the medical sector than males. Therefore, women are at a higher risk to mercury exposure through the breakage of thermometers, other mercury containing devices and equipment from working in this sector.

The majority of first responders and emergency personnel such as firefighters consist of males. They are at an increased risk of mercury exposure as they may deal with the cleaning up of mercury spills.

A more in-depth study of the gender ratios for these professions is needed to accurately confirm and quantify patterns of exposure and at-risk populations. Research should also be conducted to identify the difference in the effect of mercury exposure for men and women. Gathered information should inform a national strategy for reducing the risk of occupational exposure to mercury. The concerns and experiences of each gender should be specifically considered when developing a risk management strategy as each gender is affected in different capacities due to varying environments. Developed policies and programmes should be designed, implemented, monitored and evaluated based on the primary gender at risk for each field, and in such a way as to equally benefit both men and women.

4.2.2 Cosmetic Exposure and Gender Differences

Mercury is sometimes used in skin care products and cosmetics found on the markets throughout the Caribbean. For the purpose of skin-lightening and anti-aging soaps and creams, mercury salts are added to inhibit the formation of melanin, the pigment that gives human skin, hair and eyes their colour, and as a result lead to a lighter skin tone. Trace amounts of mercury are also legally added to some cosmetics, like mascara, for its properties as a preservative in preventing the growth of microorganisms (BRI, 2018).

It is assumed that if members of the population are indeed engaged in the use of these products, exposure would primarily be to women as global studies have indicated that women are more likely to use these products than men (Pierre-Louis, 2017). Some research has shown that the use of skin lightening creams by women with children have led to greater risks of mercury transfer to their children. (Copan, et al., 2015) detailed a case in which a 20-month old child was diagnosed with mercury poisoning which was attributed to the use of a skin lightening cream (found to contain 38,000 ppm Hg) by the child's mother.

Under the Minamata Convention, Parties have to end the import, export and manufacture of cosmetics with potentially harmful concentrations of mercury (above 1 ppm – parts per million) by 2020. As an add-on exercise to the Minamata Initial Assessment in the Caribbean, skin-lightening cream samples obtained from the participating project countries in the Caribbean were sampled for their mercury content. A total of 40 skin-lightening creams were purchased throughout the four (4) countries and sent to BRI

laboratory in Portland, Maine for analysis. Out of the samples tested, two (2) creams contained elevated levels of mercury, exceeding the 1ppm threshold established by the Minamata Convention.

In many of the Caribbean countries, labelling is not regulated, manufacturers are not required by law to list all the ingredients of their products and some labels on imported products are often written in a foreign language. Consumers of these products are therefore at risk to mercury exposure without even having the knowledge that harmful chemicals are components of the product. It is important to raise awareness nationally on the potential health risks associated with these mercury containing cosmetics to protect the well-being of the population of Antigua and Barbuda.

Chapter 5: Awareness/Understanding of the Workers and Public; and Existing Training and Educating Opportunities of Target Groups and Professionals

The level of awareness on the risks of mercury among identified stakeholders and target populations in Antigua and Barbuda vary based on the information made available to them. Measures should be put in place to educate these groups on the hazards of mercury exposure, the possible action to mitigate risks and to reduce mercury releases overall.

Article 18 of the Minamata Convention on Mercury states that:

1. *Each Party shall, within its capabilities, promote and facilitate:*
    a) *Provision to the public of available information on:*
    i. *The health and environmental effects of mercury and mercury compounds;*
    ii. *Alternatives to mercury and mercury compounds;*
    iii. *The topics identified in paragraph 1 of Article 17;*
    iv. *The results of its research, development and monitoring activities under Article 19; and*
    v. *Activities to meet its obligations under this Convention;*

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

2. *Each Party 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.*

Since becoming a Party to the Minamata Convention, the Government of Antigua and Barbuda has taken various steps to engage stakeholders at different levels to raise awareness on the issues posed by mercury and the measures that need to be taken to implement the obligations of the Minamata Convention.

The development of a communications strategy to raise awareness on the issues of mercury is also a component under the MIA project. Stakeholders from the relevant government sectors such as waste and health as well as NGO stakeholders have been made aware of the areas of focus for sound mercury management throughout the project through working group meetings.

Additionally, awareness raising materials were developed with consideration for mercury issues that are most relevant to the Caribbean context. The materials included:

1. A series of brief animated videos with accompanying 10-second-long video teasers and promotional digital flyers on the following topics:
    a. The Mercury Cycle
    b. Background on the Issue of Mercury Globally
    c. Mercury in Household Products (Figure 7)
    d. Mercury in Skin-lightening Creams and its Potential Health Effects
    e. Mercury and Diet;



Figure 7: Still image of animated video developed on mercury in household products

2. Four (4) infographics *(developed under previous GEF9455 MIA project and made available)* on the following topics:
    a. Mercury in Household Products (Figure 8)
    b. Mercury in Industrial and Medical Devices
    c. Mercury in Cosmetics
    d. Mercury and Health;



Figure 8: Excerpt of Mercury in Household Products Infographic Developed

3. Informational flyers on hair sampling and skin-lightening cream assessments conducted in the Caribbean by BRI (Figure 9);

4. National fish consumption advisory card and informational flyer on fish sampling activities conducted by BRI in Antigua and Barbuda;

5. National brochure on the State of Mercury in Antigua and Barbuda developed by BRI based on the results of the MIA project;

6. Regional brochure on the State of Mercury in the Caribbean developed by BRI based on the results of the MIA project;

7. Technical briefing documents on:
    a. National Skin-Lightening Creams Mercury Assessment;
    b. Regional Report on the Gender Assessment of MIA Project and Mercury Management;
    c. Regional Lessons Learned and Good Practices Report;
    d. Draft National Legal Briefing Note.

Based on the materials produced, a communication strategy for mercury awareness was developed for Antigua and Barbuda.

Examples of communication channels included:

1. **Social Media Platforms**: Using the different social media platforms for the Department of Analytical Services and other national stakeholders, as well as, the BCRC-Caribbean can allow the messages to reach a wide

audience as well as provide the platform to share the products with many other agencies and organisations. Many environmental NGOs can be engaged to share the material on their social platforms as well, such as Environmental Awareness Group (EAG), Caribbean Youth Environment Network (CYEN), and Zero Waste Antigua and Barbuda (ZWAB). Through the use of appropriate hashtags, the messages can be spread across the nation with little effort. The animated videos developed were launched on the BCRC-Caribbean's social media platforms between March- April 2020.

2. **Public Service Announcements via Television and Radio Platforms:** Engaging popular news channels and radio stations is another media form to ensure visibility of the videos produced. Key stakeholders of Antigua and Barbuda indicated that Antigua and Barbuda Broadcasting Service (ABS) is a prime media platform to raise awareness on nation-wide issues.

3. **Public Service Announcements via Cinemas:** The two-minute videos can be placed as a screen advertisement before a movie showing in Caribbean Cinemas in Antigua and Barbuda. As a media platform, cinema advertisements have the lowest ad avoidance due to the focus of the captive audience as many moviegoers perceive the ads as part of the overall experience.

4. **Environmental Campaigns and Events:** Many countries have nation-wide awareness events or campaigns to increase public education on current environmental concerns. Joining efforts and resources can add value to these environmental events and increase the general knowledge base of the population. Many campaigning events reach a large variety of target groups.



Figure 9: Image of Skin Lightening Creams developed by BRI under the project.

5. **Partnering with NGOs, Youth Groups or Other Project Initiatives:** Many environmental NGOs, youth groups, Rotary Clubs and community groups already have a following or an audience to engage when spreading a message. These awareness-raising products, along with the supporting document and a brief training done by the National Supervisor and/or BCRC-Caribbean, can be shared among interested groups to assist with

carrying the message further with joint efforts.

6. **Engaging Local Health Institutions and Store Owners:** Contacting local stores that sell certain mercury-added products, such as skin-lightening creams or CFL bulbs, can allow for the messages to be understood from the seller's perspective. The flyers or infographics provided can be put in the stores to potentially influence the consumer's behaviour at the direct source. Similarly, with community health institutes, flyers can be placed in the waiting room to engage specific target groups such as pregnant women or women of child-bearing age. Some health institutes have television screens or monitors in the waiting room which can also show the animated videos.

7. **Engaging Students at Primary and Secondary Level:** Through coordination with the Ministry of Education, there are multiple approaches that can be taken to engage students to raise awareness on these mercury issues. One approach can include engaging schools with the provision of an educational package, including a brief training or instruction set for the teachers. This will allow for the information to be incorporated into their lesson plans, curriculum or as a school assembly programme. Another approach can be to host a student workshop where specific classes or students from different schools can attend. These workshops can include presentations, theatre-style video viewing, a drama skit on the topic (Figure 10) and an interactive question-and-answer engagement session.



Figure 10: Local Drama Youth Group mercury awareness skit under the GEF9455 MIA Project previously executed.

8. **Engaging Policy Makers:** In addition to the National Minamata Initial Assessment Report, the communications package includes many technical briefing documents which will provide information to all key stakeholders and government officials. These documents provide the results of the different components of the project, including the results of the add-on sampling initiatives. These materials will assist in high-level stakeholder engagements or in drafting relevant cabinet briefing notes to promote the enforcement of the Minamata Convention.

The communication strategy can be tailored to meet the priorities of Antigua and Barbuda, given the available resources, collaborations and network in the country.

Table 30 summarises considerations for dissemination of the materials developed based on particular target audiences.

In Antigua and Barbuda, there have been numerous efforts to raise awareness and understanding of key workers and the public. Under the GEF Small Grants Programme, the project entitled, “Contribution towards ratification and implementation of the Minamata Convention on Mercury and towards phasing out of mercury-added products in Antigua and Barbuda” includes an objective specifically towards the national increase in public awareness about the dangers of mercury through engagement of stakeholder such as Customs and persons in the waste sector.

Collaboration between this project and the MIA project will be conducted from 2020-2021 for the execution of the communication strategy. Due to the onset of the Covid-19 pandemic, the communication strategy developed under the MIA Project was updated for implementation in 2021.

Table 30: Target Audience Considerations for Dissemination of Communication Material

Audience	Key Message	Channel
General Public / Households	• **Diet:** All products listed • **Health:** Animated Video with associated material and Infographics • **Consumer Products:** All products listed • **Mercury situation in the Caribbean:** Animated Videos with associated materials and live-action video.	Social Media Television Radio Cinemas Community Meetings Posters & Flyers Training of community health professionals and NGOs for further dissemination
Students	• **Diet:** All products listed • **Health:** All products listed • **Consumer Products:** All products listed • **Mercury situation in the Caribbean:** Animated Videos with associated materials and live-action video.	Social Media Cinemas Posters Student Engagement Workshops Training of teachers and incorporating into lessons plans
Pregnant Women and Women of Child-bearing age (18-44)	• **Diet:** All products listed • **Health:** Animated Video with associated material, Infographics and Flyer • **Consumer products:** Infographics • **Mercury situation in the Caribbean:** Animated Videos with associated materials and live-action video.	Social Media Posters in Health Centres or Doctor/Dentist offices Cinemas Television Radio Training of health professionals and NGOs/Women's Groups for further dissemination
Private Sector, Importers and Retailers	• **Consumer products:** All products listed	Stakeholder Meetings Television
Government Agencies / Policy Makers	*Although all products can be used, the more technical products are listed here. • **Diet:** Fish Card and Flyer • **Health:** Infographic Flyer and Report • **Consumer Products:** Infographic	Television Briefing Meetings Government Awareness Events Training of customs and health officials

Chapter 6: Implementation Plan and Priorities for Action

Article 20 of the Text of the Minamata Convention on Mercury states that, “each Party may, following an initial assessment, develop and execute an implementation plan, taking into account its domestic circumstances, for meeting the obligations under this Convention” (UNEP, 2019b). The development of an implementation plan is the responsibility of the respective Government and is optional.

Financial assistance for the implementation of national priority actions is available for Parties to the Minamata Convention as per Article 13 which establishes a mechanism for the provision of financial resources through the Global Environment Facility Trust Fund and a Specific International Programme to support capacity building and technical assistance. Article 14 further lists provisions for capacity building, technical assistance and technology transfer to developing country Parties and countries with economies in transition through regional, sub-regional, national, multilateral and bilateral arrangements and partnerships.

Chapter 3 of this report provided an outline of the legislative recommendations for consideration in the implementation of the Minamata Convention. This Chapter highlights some of the practical considerations, based on the findings of the inventory, that may be taken should the Government of Antigua and Barbuda choose to develop an implementation plan and a list of priorities for action to aid in the reduction of national mercury releases and emissions.

Priority 1: Phase-Out or Phase-Down of Mercury-Added Products

Based on the results of the inventory, the largest source of mercury to Antigua and Barbuda is from the use and disposal of MAPs.

To facilitate the phase-out or phase-down of mercury-added products regulated under the Minamata Convention, the Government of Antigua and Barbuda, through the Bureau of Standards, should establish standards that restrict the import of MAPs for which there are available mercury-free alternatives. Maximum allowable mercury content should be set and enforced for products that have no available mercury-free alternatives and transparent product labelling should be ensured. The development of new standards and selection of suitable mercury-free alternatives should be based on research and collaboration with national stakeholders to ensure the effectiveness of measures put in place.

National import regulations for mercury added products should be strengthened to facilitate the enforcement of established standards. Antigua and Barbuda is a member of the World Customs Organisation and the country uses the 6-digit Harmonised System (HS) codes implemented in 183 countries and overseen by the World Customs Organisation. However, mercury added products are not specifically identified through the HS codes. National sub-codes to distinguish between mercury-added products and non-mercury containing products may be created at the discretion of national authorities (Global Mercury Partnership, 2018).

Added digits should be specifically defined as an indicator of the presence of mercury in

the imported item. For example, the Environment Directorate of Uruguay established a Working Group to create tariff codes for mercury-added medical devices resulting in the addition of sub-codes to differentiate between liquid clinical thermometers with and without mercury (UNEP, 2019c).

- 9025.11 Liquid thermometers
- 9025.11.10 Clinical thermometers
- 9025.11.10.10 Clinical thermometers containing mercury
- 9025.11.10.90 Other clinical thermometers

Officers from the Customs and Excise Department should be trained in the identification of the designated codes and recording of mercury-added imports to support the implementation of policies and legislation related to mercury.

There is global support for the development of an international approach for implementing mercury-specific HS codes through the UN Global Mercury Products Partnership. • Promotion of mercury-free consumer products which are already widespread on the market. As part of the approved GEF Small Grants Programme, the project entitled, “Contribution towards ratification and implementation of the Minamata Convention on Mercury and towards phasing out of mercury-added products in Antigua and Barbuda” an objective specifically towards the national increase in public awareness about the dangers of mercury through engagement of stakeholder such as Customs and persons in the waste sector is included. Collaboration between the lead agency of this project, the Zero Waste Antigua and Barbuda Group, and the MIA project will be carried on throughout 2020-2021 for the execution of the communication strategy.

Other general recommendations for the phase-out or phase-down of MAPs including the promotion of alternative mercury-free products and preventing the import and use of certain MAPs are highlighted in Table 31.

A significant challenge to implementing the recommendations provided in Table 31 is the existence of an unfounded perception that some mercury-free alternatives do not perform as precisely and accurately as their mercury-containing counterparts. Therefore, although there is a general push to promote the use of mercury-free and mercury-reduced alternatives in Antigua and Barbuda, there is still a need to increase public awareness on the hazards of mercury and the benefits of using mercury-free alternatives to encourage a higher substitution rate.

Table 31: General recommendations for phasing out or phasing down mercury added products listed in Annex A

MAP	Recommended Action for Phase-Out
Switches and Relays	• Promote the use of Hg-free alternatives which are already widespread on the market. For example, electronic mercury-free alternatives are proven effective and widely available and many manufacturers now produce mercury-free switches and relays because of restrictions in the EU's RoHS Directive. Mercury-free alternatives include hybrid tilt switches and electronic thermostats.[6] • Take measures to prevent use as components in larger products like pumps, appliances, ovens and circuit boards. • Ensure that allowable high accuracy capacitance and loss measurement bridges and high frequency radio frequency switches and relays in monitoring and control instruments maintain a maximum mercury content of 20 mg per bridge, switch, or relay. • Set up waste electrical and electronic equipment (WEEE) dismantling plants to remove switches and relays from non-hazardous waste streams.
Batteries	• Promote the use of Hg-free alternatives, such as cylinder (alkaline rechargeable) batteries which are already common on the market.[6] • Prevent the import and use of mercury containing batteries in devices used for medical, industrial or military applications and electronics. • Ensure that allowable mercury-containing button zinc silver oxide and button zinc air batteries used maintain acceptable limit of <2% Hg content. This limit is typically in accordance with the batteries on the global market currently. • Put measures in place, e.g. WEEE dismantling plants, to remove batteries from non-hazardous waste streams.
Lighting Devices (CFLs, LFLs, HPMV, CCFLs, EEFLs)[7]	• Promote the use of LEDs and other Hg-free lamp alternatives for general purpose lighting and LCD backlighting.[6] (The amount of Hg needed per lamp has decreased over the years due to technology/production improvements, including better dosing; therefore, meeting this requirement globally is becoming easier. The People's Republic of China which manufactures many of these products for worldwide export is Party to the Minamata Convention and have implemented plans to meet the obligations for manufacture in accordance with the Convention's obligations [Kamande, 2017]). • Set and enforce low maximum mercury content limits for lamps imported and used. • Restrict the use of HPMV and enforce the use of available alternatives. • Purchase bulb-eaters to facilitate recycling or environmentally sound disposal of

[6] Some of the recognised existing guidance documents are available at the following links (Kamande, 2017):
- Report on the major mercury-containing products and processes, their substitutes and experience in switching to mercury-free products and processes, UNEP OEWG2: http://www.mercuryconvention.org/Portals/11/documents/meetings/oewg2/English/2_7.pdf
- Mercury-added Product Fact Sheets, Northeast Waste Management Officials Association: http://www.newmoa.org/prevention/mercury/imerc/FactSheets/
- Developing National Strategies to Phase Mercury Out of Thermometers and Sphygmomanometers Including in the Context of the Minamata Convention on Mercury, WHO: http://www.who.int/ipcs/assessment/public_health/WHOGuidanceReportonMercury2015.pdf

[7] Compact fluorescent lamps (CFLs), linear fluorescent lamps (LFLs) and high-pressure mercury vapour lamps (HPMV) are used for general lighting purposes; Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) are used in electronic displays.

MAP	Recommended Action for Phase-Out
	end-of-life fluorescent tubes. • Set up WEEE dismantling facilities to separate CCFLs and EEFLs from non-hazardous waste streams.
Non-Electronic Measuring Devices **(Barometers, Hygrometers, Sphygmomanometers, Thermometers etc.)**	• Promote the use of cost-effective Hg-free alternatives. Digital and aneroid Hg-free alternatives to these products are already popular on the global market. Guidance documents on phasing out these products have been developed by the WHO and Health Care Without Harm who began a global campaign to shift the production of mercury-added medical devices to Hg-free alternatives by 2017.[6] • Enforce on-site separation of these devices from non-hazardous waste streams and waste incineration streams.
Cosmetics (Skin Lightening Products)	• Establish measures to regulate the import and local manufacture of skin lightening products. • Compile a local inventory of mercury containing cosmetics to better inform governments and public.[8] • Develop and enforce proper and transparent labelling standards. • Promote the use of cost-effective Hg-free alternatives. • Ban the manufacture, import and export of mercury-added cosmetics. • Conduct public awareness campaigns.
Dental Amalgam	• Encourage the use of cost-effective and clinically effective mercury-free dental restoration options to phase-out the use of Hg-added dental amalgam. • Provide training and education opportunities for professional dentists and students in dental school on mercury-free dental restoration options and best practices[8] to prevent release of mercury into the environment.

Priority 2: Strengthening of the national capacity to test and monitor mercury in human health and the environment.

Overall, in the Caribbean, there is a need for greater resources and capacity to monitor mercury in the environment. Periodic monitoring and evaluations are needed to ensure that potential mercury sources are

[8] To prevent the release of mercury into water supplies during the removal of existing mercury-containing dental amalgams, dentists should be strongly encouraged to purchase brands of dental chairs that are fitted with amalgam separators which trap excess amalgam. Amalgam captured by the filters should be captured during periodic cleaning efforts, and the mercury-containing waste should be transported to a facility for recycling. Temporarily stored dental amalgam should utilise the underwater storage method outlined on page 13 of the UNDP/GEF Global Healthcare Waste Project: "Guidance on the cleanup, temporary or intermediate storage, and transport of mercury waste from healthcare facilities" document (Emmanuel, 2010).

identified and control methods are effectively reducing the mercury releases and emissions in the environment.

Under the 2019 second round of the Specific International Programme, Antigua and Barbuda was awarded funding for "Facilitating capacity-building with technical assistance and technology transfer for managing mercury in the Caribbean" in which a Caribbean Region Mercury Monitoring Network will be set up. The Network will ensure the strengthening of national laboratory capacity and assess mercury in air deposition, fish, birds, humans and cosmetics. This activity was planned to commence in 2020, however, due to the Covid-19 pandemic, it will likely take place from 2021.

Priority 3: Environmentally Sound Management of Mercury Wastes

Many household consumer products and medical waste products that contain mercury or mercury compounds end up at the national landfills mixed in with municipal waste. Even after the importation of mercury added products is phased-out, it is expected that the generation of wastes containing mercury will continue due to the extensive lifespan of some mercury added products. Proper waste management methods are therefore essential for the protection of Antigua and Barbuda's health and environment from releases of mercury.

While some of the mercury used in products can be collected and recycled, Antigua and Barbuda faces issues which reduce the feasibility of such measures. These issues include a lack of enforced requirements for manufacturers to list all of the components of their products, which leaves users and disposers unaware of the need for special disposal; inefficient collection, waste separation, and disposal systems; a lack of access to storage and recycling facilities; and little public awareness on the hazards of mercury-added products and their proper disposal. Further, the small amount of mercury that may become available for national recovery may not be enough to develop an economically viable system.

Information that may contribute to the development of mercury waste thresholds was submitted to the second meeting of the COP to the Minamata Convention (UNEP, 2018). This information included national data presented by experts such as:

- Mercury compounds in use;
- Mercury added products in use;
- Data on mercury content in waste contaminated with mercury or mercury compounds;
- Existing mercury thresholds in national legislation; and
- Proposed threshold values for mercury concentrations.

The suggested threshold values could be used to inform the development of standards for the environmentally sound disposal of mercury wastes, and to establish guidelines for reducing health risks caused by emissions and releases of mercury from the mismanagement of mercury-containing wastes.

Development of proper separation methods for the disposal of mercury-added products both at the household consumer level and in landfill management procedures is

necessary for sound management of mercury releases in Antigua and Barbuda. The Government should ensure that the public has access to environmentally sound facilities/locations that could aid in the disposal process, as well as information and guidelines on disposing mercury added products. Source separation of wastes containing mercury should be encouraged, and a nation-wide collection system should be established to reduce the landfilling of mercury wastes. Training of waste management personnel, as well as educating the general public on the identification of mercury added products are necessary to ensure the effectiveness of implemented measures.

Under the GEF Programme, ISLANDS of which Antigua and Barbuda is a participant, sound management of chemicals and waste will be addressed through strengthening the capacity of sub-national, national and regional institutions and strengthening the enabling policy and regulatory framework in project countries. Mercury management will be largely addressed under this Programme planned for 2021- 2026.

Priority 4: Integration of gender into mercury abatement projects.

Under the rapid analysis conducted by Gender Consultant, Ms. Candice Ramessar, the importance of including sensitivity guidelines for engendering projects addressing mercury pollution was highlighted. Table 32 provides suggested guidelines that can be considered in the development and implementation of mercury and overall chemicals management initiatives.

Table 32. Integrating Gender into Mercury Abatement Projects

INTEGRATING GENDER INTO MERCURY ABATEMENT PROJECTS			
Planning Stage	**Design Stage** Gender considerations should be implemented in the design framework and organisation of the project	**Implementation Stage**	**Monitoring and Evaluation Stage**
Identify key gender issues and considerations related to chemicals and waste management (through literature review and general research). **Determine** how gender inequalities affect exposure to mercury pollution (through literature review and interview with experts from the scientific and gender fields. **Identify** structural and other societal factors for men and women (but particularly women) exposure and vulnerability to mercury pollution (this can be done through a literature review of gender documents of the country and region including Country Gender Assessments and Poverty Assessments as well as reports on Social Protection and Human Rights). **Acknowledge** and note women's and fetuses' vulnerability to chemical pollution and exposure (Collation of notes from the	**Allocate** resources for the conduct of a gender analysis (In the early stages of the project preparatory phase assign a budget line item for the carrying out of gender analysis. Some donors such as the GEF provide a grant for the preparation of projects. The gender analysis should be done by someone who is experienced in the field of gender or other social sciences field with experience in gender studies or practice. **Procure** gender expert to conduct gender analysis. **Conduct** gender analysis of chemical pollution and gender in the area of focus. (For national and regional projects, the gender analysis can focus on the gender issues at the national and regional levels. However, if the project will work in local communities and those communities are known then the gender analysis should also focus on the local/community levels. Gender Analysis typically asks the questions. **Refine** gender issues and considerations identified in the planning stage. **Incorporate** gender in the project results framework by developing sensitive/responsive programme objectives. **Define** goals, objectives outcomes, outputs, and activities that will contribute to addressing both women's and men's needs.	**National** gender awareness and sensitisation at inception workshops to demonstrate the projects commitment to gender equality and mainstreaming. **Adopt** a gender mainstreaming strategy in the project policies. **Build** the capacity of the programme's team and partners to conduct gender analysis and mainstream gender. **Implement** gender action plan, including ensuring the allocation of specific and sufficient resources (financial, human, time) to enable the achievement of programme objectives. **Implement** activities in a culturally sensitive manner. **Conduct** activities that leverage other gender interventions in the country (including the National Gender Agencies and Women representative organisations) or region and use them to build political commitment and community support. **Highlight** women vulnerability in mercury pollution and their potential as powerful advocates in raising awareness of the issue.	**Adopt** an M&E process and methodology to capture the gender dimension of the programme. **Define** quantitative and qualitative gender-sensitive indicators to measure projects impact on men and women have contributed to addressing the issues and achieving the expected outcomes, and to what extent the programme has equitably addressed both women's and men's needs. **Develop** culturally sensitive and gender-specific data collection tools and methodologies. **Conduct** culturally sensitive and gender-specific data collection exercises including single-gender activities and activities respectful of women and men's schedules and social and reproductive roles.

literature review and interviews).	**Develop** criteria for participation in project activities that will ensure gender balance in participation. **Ensure** social inclusivity by the design of activities to reach all sectors of society, especially vulnerable populations. **Ensure** that programmes and activities reflect socio-ethnocultural sensitivity. **Embed** in the project design the socio-ethnocultural and gender sensitivity especially in awareness, communications, monitoring, and evaluation programme activities and these activities promote gender equality and the empowerment of women and men. **Develop** a gender action plan with a budget based on the proportionality of the project. **Allocate** resources for the gender action plan implementation including human resources. **Identify** clear responsibilities for the gender action plan or gender sensitivity activities including the allocation of specific personnel.	**Advocate** for gender mainstreaming as essential in addressing the issue of chemical pollution in the countries and regions.	

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Annex 1: Stakeholder Engagement Process

The following table gives the institutions, organisations and ministries that were instrumental in the development of the MIA Report. The various representatives from these bodies were interviewed and contributed to the data collection component of the report.

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27		Mr. Sherwin Wiltshire	Landfill Supervisor	Sir George Walter Highway, St. John's	sherwin-wiltshire@hotmail.com	W: 562-2021/562-1348 M: 720-6124

28	Public Health Department	Mr. Claude Burton	Landfill Manager	Codrington, Barbuda	burton.kidzclaude@gmail.com	M: 771-4345
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Annex 2: UNEP TOOLKIT Calculation Spreadsheet

The UNEP Toolkit Calculation Spreadsheet is available for download at the following link:

https://bcrccaribbeanorg-my.sharepoint.com/:x:/g/personal/info_bcrc-caribbean_org/Ea88_eITJnZBrVjW-vE2qjIBYqyaTzCcu5ghULUa5_Or7w?e=svL0x8

Should any issues occur in accessing the link provided, please contact info@bcrc-caribbean.org.