The Government of the Republic of Trinidad and Tobago

TRINIDAD AND TOBAGO
MINAMATA INITIAL ASSESSMENT REPORT





DEVELOPMENT OF THE MINAMATA INITIAL ASSESSMENT IN THE CARIBBEAN



(Jamaica, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago)

AUGUST 2018

gef

UN environment
United Nations Environment Programme

Basel Convention Regional Centre for Training and Technology Transfer in the Caribbean

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TRINIDAD AND TOBAGO MINAMATA INITIAL ASSESSMENT REPORT

PUBLISHED 2018

Prepared by the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean) under the GEF Project: “Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, Trinidad and Tobago).

GEF IMPLEMENTING AGENCY
UN Environment

NATIONAL EXECUTING AGENCY
Environmental Policy and Planning Division
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ABOUT THIS DOCUMENT

The Trinidad and Tobago Minamata Initial Assessment Report was developed under the project, "Development of Minamata Initial Assessment in the Caribbean: Jamaica, Saint Kitts and Nevis, Saint Lucia and Trinidad and Tobago".

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 (UN Environment; formerly 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 Environmental Policy and Planning Division (EPPD) of the Ministry of Planning and Development.

The development of the Report was guided by the Biodiversity Research Institute who was contracted as the lead technical consultancy by the BCRC-Caribbean. The report consists of an inventory of mercury releases primarily based on 2016 data. Assessments and recommendations for the effective implementation of the Minamata Convention were conducted. Data collection was conducted by a National Project Coordinator hired by the BCRC-Caribbean.

This inventory was performed in accordance with UN Environment's "Toolkit for identification and quantification of mercury releases", Inventory Level 2 (version 1.04, January 2017).

The report also includes an assessment of the legislative and institutional framework in relation to the implementation of the Minamata Convention on Mercury which was developed by the legal consultant contracted under the project, Dr Winston McCalla. 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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Report issuing date	August 2018

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List of Abbreviations

AMAP	Arctic Monitoring and Assessment Programme
APR	Air Pollution Rules
BAT	Best Available Techniques
BCRC-Caribbean	Basel Convention Regional Centre for Training and Technology Transfer in the Caribbean
BET	Best Environmental Practices
bopd	barrels of oil per day
CBOs	Community based organisations
CEC	Certificate of Environmental Clearance
CCFLs and EEFLs	Cold Cathode Fluorescent Lamps and External Electrode Fluorescent Lamps
CFLs	Compact Fluorescent Lightbulbs
DCTT	Dental Council of Trinidad and Tobago
DMA	Direct Mercury Analyzer
EC	European Commission
EM	Environmental Management
EMA	Environmental Management Authority of Trinidad and Tobago
EPPD	Environmental Policy and Planning Division
EPR	Extender Producer Responsibility
EU	European Union
GEF	The Global Environment Facility
GIS	Geographic Information System
GoRTT	Government of the Republic of Trinidad and Tobago
Hg	Mercury
IMA	Institute of Marine Affairs
kg Hg/y	Kilograms of mercury per year
km	Kilometre
LCD	Liquid Crystal Display
LED	Light-emitting Diode
LFL	Linear Fluorescent Lamps
LNG	Liquified Natural Gas
NEP	National Environmental Policy
NGOs	Non-Governmental Organisations

Nm^3/y	Normal cubic metre per year
m^3/y	Cubic metre per year
MAPs	Mercury-Added Products
MEAs	Multilateral Environmental Agreements
MEEI	Ministry of Energy and Energy Industries
mg	Milligram
MIA Project	Development of the Minamata Initial Assessment in the Caribbean Project
mL	Millilitre
mmscf/d	Million Standard Cubic Feet per day
MSW	Municipal Solid Waste
OSHA	Occupational Safety and Health Authority
PETROTRIN	Petroleum Oil Company of Trinidad and Tobago
PPE	Personal Protective Equipment
PPGPL	Phoenix Park Gas Processors Limited
ppm	Parts per Million
SEL	Specially Engineered Landfills
SIDS	Small Island Developing State
sq km	Squared Kilometres
SWMCOL	Trinidad and Tobago Solid Waste Management Company Limited
T&TEC	Trinidad and Tobago Electricity Commission
t Hg/y	Tonnes of mercury per year
t/y	Tonnes per year
TCL	Trinidad Cement Limited
THA	Tobago House of Assembly
TTBS	Trinidad and Tobago Bureau of Standards
UN ECOSCO	United Nations Economic and Social Council
US EPA	United States Environmental Protection Agency
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNITAR	United Nations Institute for Training and Research
UWI	University of the West Indies
WASA	Water and Sewage Authority of Trinidad and Tobago
WEEE	Waste Electrical and Electrical Equipment

WHO	World Health Organization
WPR	Water Pollution Rules
ww	wet weight

Acknowledgements

The Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean) expresses thanks to the Global Environment Facility (GEF) for facilitating the funding of the project, "Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Lucia, Saint Kitts and Nevis and Trinidad and Tobago)" and to the UN Environment for acting as the implementing agency.

The BCRC-Caribbean also wishes to recognise the Ministry of Planning and Development, Environmental Policy and Planning Division (EPPD), for their support in the national execution of the project, especially Ms. Keima Gardiner, Waste Management Specialist, EPPD, who acted as the National Supervisor for this project.

Further thanks go out to the Biodiversity Research Institute, the lead technical consultancy led by Dr David Evers and previously by Dr David Buck; and to the legal consultant Dr Winston McCalla.

The BCRC-Caribbean is also grateful to the National Project Coordinator, the National Working Group and all stakeholders involved in the project as they have been instrumental in the gathering and identification of information and data on mercury releases and sources in the country. They have also played a critical role in supporting the review process of this report as well as participating in the national workshops related to the project. Some of the key agencies who contributed to the execution of the project include:

The Environmental Management Authority (EMA), the Tobago House of Assembly (THA), Trinidad and Tobago Solid Waste Management Authority (SWMCOL), Customs and Excise Division, Ministry of Energy and Energy Industries (MEEI), Trinidad and Tobago Electricity Commission (T&TEC), Trinidad Cement Limited (TCL), the Dental Council of Trinidad and Tobago (DCTT), the University of the West Indies (UWI) St. Augustine, Water and Sewage Authority (WASA), and United Nations Institute for Training and Research (UNITAR). A detailed list of Project Stakeholders who participated in national workshops is provided in Annex 1 of this report.

Executive Summary

The Minamata Convention on Mercury is a global treaty that aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds to the environment. Mercury is a naturally occurring element in the Earth's crust, and although various natural processes contribute to the release of mercury, the anthropogenic causes are the source of utmost concern. As mercury enters the environment, it persists and cycles through the various environmental media. The World Health Organization (WHO) lists mercury as one of the top ten (10) chemicals of major public health concern as it is toxic to both humans and animals.

The Minamata Convention on Mercury aims to implement measures to, *inter alia*, reduce the emissions and releases of mercury from products and processes, phase-out the use of mercury-added products and provide environmentally sound management of the storage and disposal of mercury waste. The Government of the Republic of Trinidad and Tobago has indicated that while it supports the objective of the Minamata Convention to protect human health and the environment from the effects of mercury, it is not yet in a position to ratify the Convention due to absence of information. In this regard, Trinidad and Tobago participated in the project "Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, and Trinidad and Tobago)" (MIA Project) which aims to facilitate the national decision-making for the ratification of the Minamata Convention in the participating countries and to further build the national capacity to administer future obligations of the Convention.

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 (formerly United Nations Environment Programme Chemicals). This project utilized 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 Trinidad and Tobago, 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 polyurethane products with mercury catalysts, cosmetics containing mercury, laboratory chemicals and equipment, miscellaneous mercury-added products, and informal waste burning. 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 National Mercury Inventory in Trinidad and Tobago

Utilizing the data received with the Toolkit spreadsheet calculations, the total estimated mercury releases in Trinidad and Tobago were 4,435 kilograms of mercury per year (kg Hg/y) and the top three sectors for mercury releases were:

1. Extraction and Use of Fuels/Energy Sources
2. Waste Incineration and Burning
3. Consumer Products with Intentional Use of Mercury (whole life cycle)

The major contributing source categories for mercury releases are highlighted in Figure 1 and the releases estimated to various output pathways are summarised in Figure 2.

Trinidad and Tobago is the largest producer of oil and natural gas in the Caribbean region. The extraction and use of fuels/energy sources was determined to be the most significant source category, accounting for 77.05% (3,653.8 kg Hg/y) of total mercury releases estimated. It is however, important to note that this estimation was based on various assumptions detailed below and not actual measurements. Compared to other source categories, the sector was also estimated to have the largest mercury outputs to

the pathways: sector-specific treatment/disposal (2,174.0 kg Hg/y), water (725.9 kg Hg/y) and by-products and impurities (361.9 kg Hg/y). This was mainly due to assumptions that naturally present mercury impurities contained in natural gas are mobilised to the biosphere during extraction and refining processes. During stakeholder consultations, representatives from natural gas processing companies indicated that measures to control pollution releases were already in place in some instances and, mercury concentrations in natural gas processed were regularly monitored and typically found to be low or at times below the detectable limit. Therefore, it can be assumed that the mercury concentrations determined for this sector from the inventory are likely to be over-estimations; however continued monitoring and evaluation of mercury releases are encouraged.

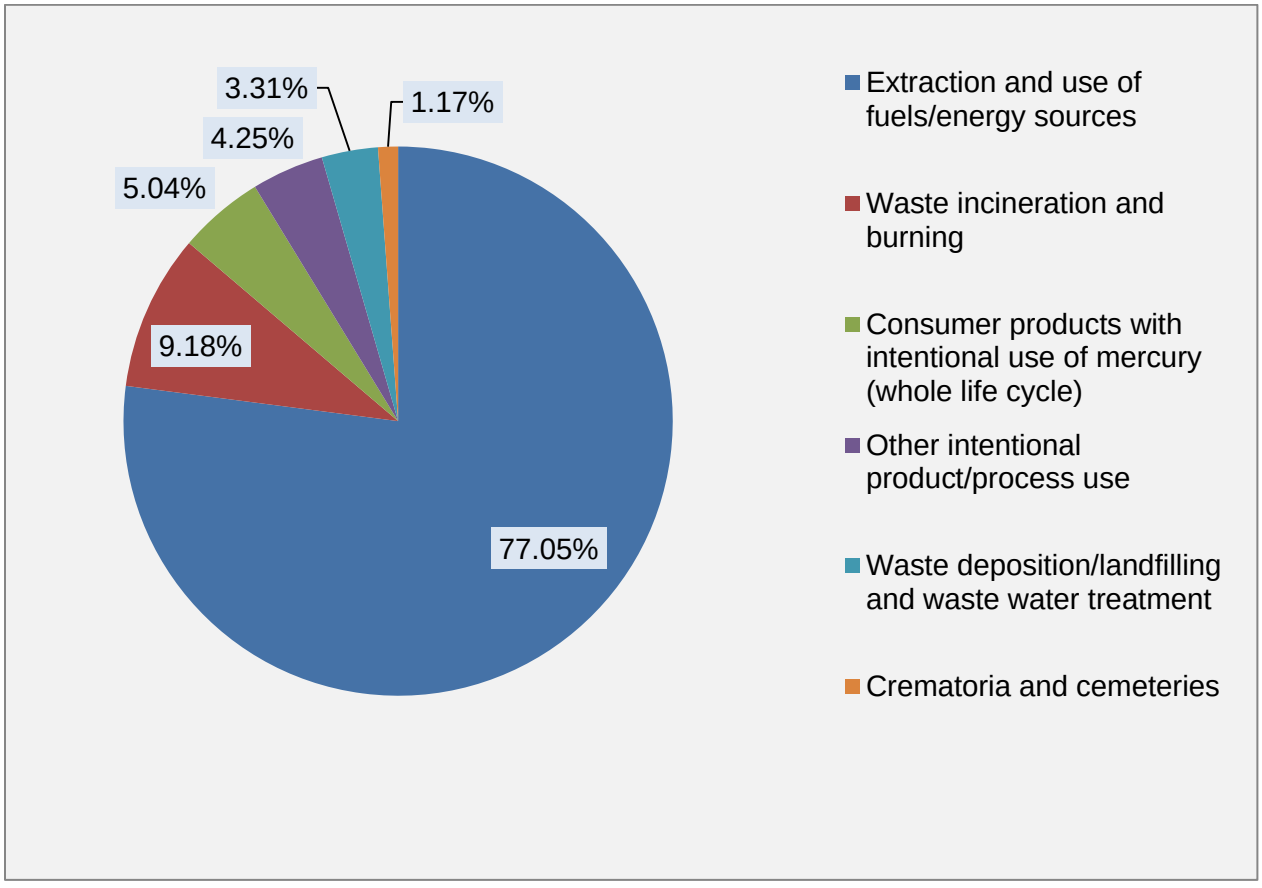


Figure 1: Estimations of total releases from the major sources of mercury identified in the mercury inventory conducted using primarily 2016 data for Trinidad and Tobago

The second highest source of mercury releases was found to be waste incineration and burning at 9.18% (435.2 kg Hg/y) which also contributed to the highest mercury releases estimated to air at 434.4 kg Hg/y when compared to other sources. The releases determined from this sector were mainly due to the input of data for very rough estimations of the volumes of waste burnt annually at three (3) of the main landfills in the country, obtained from the Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL). Mercury is present in waste due to the disposal of mercury added products, and the burning of waste at landfills by the informal waste handling sector has been noted to occur.

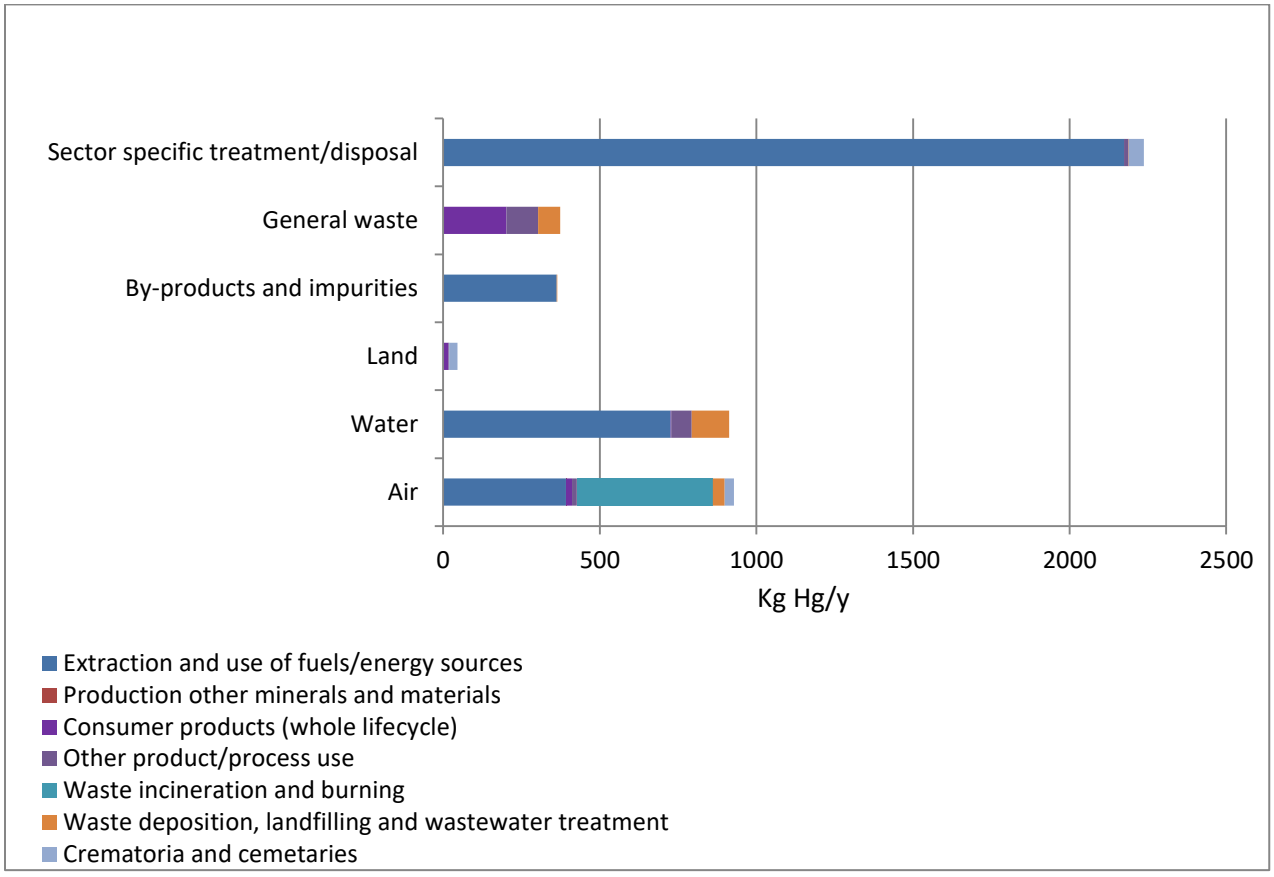


Figure 2: Estimations of releases to each output pathway from the major sources of mercury identified in the mercury inventory conducted using 2016 data

The use and disposal of mercury-added consumer products resulted in estimated mercury releases of 238.9 kg Hg/y (5.04%) and was the third ranked source. The disposal of mercury-added products accounted for the largest mercury outputs to the general waste output pathway at 201.4 kg Hg/y. These estimations were mainly due to the assumed use and disposal of mercury-added electrical switches and relays over the last twenty (20) years, which resulted in approximately 168.4 kg Hg/y being released in total. This was based on the assumption that all switches and relays used in Trinidad and Tobago contained mercury and the releases were determined using default calculations based on population data and electrification rate. Therefore, releases estimated are likely an over-estimation. Releases from mercury-added batteries (36.16 kg Hg/y), light sources (28.74 kg Hg/y) and thermometers (5.55 kg Hg/y) also contributed to the estimations for the consumer products category and were determined based on input data received mainly from the Customs and Excise Division. The use and disposal of mercury-added skin lightening cosmetics were identified as being present, however due to the informal trade of these products, data on this source could not be quantified at the time of the inventory. It was also not confirmed whether the use and disposal of polyurethane with mercury catalysts occurred in Trinidad and Tobago.

Other sources of mercury releases were found to be: other intentional product/process use (included the use and disposal of medical blood pressure gauges and the preparation, use and disposal of dental amalgam) at 4.25%; waste deposition/landfilling and wastewater treatment (3.31%); and crematoria and cemeteries (1.17%).

In terms of mercury or mercury compound stocks, it was determined that no significant stockpiles (exceeding 10 metric tons per year) are present in Trinidad and Tobago.

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

In terms of contaminated sites, the Minamata Convention has no mandatory obligations, but the development of strategies for identifying and assessing sites contaminated by mercury or mercury compounds is recommended. This was initiated under the MIA Project. 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. The results were presented in a map which showed that watersheds surrounding the south-west of Trinidad are the most sensitive to mercury methylation with the watersheds towards the south-west of Tobago are moderately sensitive to mercury methylation. The relationship between mercury contamination and disposal sites was not confirmed from the information obtained. The model developed can be used to further assessments in determining mercury contaminated sites as suggested under Article 12 of the Minamata Convention.

Exposure to elemental mercury and mercury compounds can pose a higher risk to certain populations that are more sensitive to its effects or have an increased frequency of exposure. In Trinidad and Tobago, these groups include pregnant women and women of childbearing age, foetuses, new-borns and young children, individuals with health-related preconditions, populations with a regular diet of contaminated high trophic level aquatic organisms, and individuals who consistently use mercury-added products such as skin-lightening creams with mercury. Also at risk are workers regularly exposed to mercury and people living in areas that are more susceptible to environmental contamination by mercury such as locations surrounding the main landfills and other disposal sites, power plants, and other industrial facilities that release mercury into the environment.

Skin-lightening creams are generally more popular among women than men, and the risk of using products containing mercury is therefore likely to be higher in the female population. Based on the lack of preliminary information gathered, a more in-depth study of the gender ratios for these professions would be required to accurately confirm and quantify patterns of exposure and at-risk populations, according to gender and occupation type.

Major Findings of the Policy, Regulatory and Institutional Assessments

An assessment of the policy, regulatory and institutional framework related to mercury management was conducted under the MIA project by legal consultant, Dr. Winston McCalla.

The lack of appropriate legislation to implement certain components of the Minamata Convention was the main barrier identified. This barrier can be overcome by the enactment of new legislation, or in appropriate cases, the promulgation of regulations under existing legislation. Details of such recommendations are listed in Table 1. It should be noted that under the Minamata Convention, Article 4 is the only article relevant to Trinidad and Tobago that has stipulated deadlines for compliance. It states that a Party must dis-allow the manufacture, import and export of certain mercury-added products listed in the Convention by 2020, unless the Party applies for an exemption as detailed in Article 6 upon ratification of the Convention. Therefore, should Trinidad and Tobago decide to become a Party, priority should be placed on the legislative amendments recommended pertaining to mercury-added products.

Table 1: Legislative Recommendations for the effective implementation of the Minamata Convention

Legislation/ Regulations	Recommendation
Environmental Management Authority Act	Promulgate the Waste Management Rules in accordance with Section 55 of the Environmental Protection Act.
	Amend the Environmental Management Act (or promulgate Rules under the Act) to control the releases of mercury and mercury compounds to land.
Toxic Chemicals Regulations	Amend Regulation 35 of the Toxic Chemicals Regulations to provide that the import of mercury or mercury compounds is prohibited and that no licence can be issued for the import of mercury or mercury compounds.
	Amend Regulation 35 of the Toxic Chemicals Regulations to provide strict stipulations to the export of mercury or mercury compounds.
Standards Act	Issue appropriate standards for products (especially skin lightening cosmetics) listed under Annex A, Part I and Part II of the Minamata

Legislation/ Regulations	Recommendation
(Chapter 82:03)	Convention to ensure compliance with the Convention's obligations.
Customs Act	Amend the provisions under Section 45 of the Customs Act that deals with the prohibition of goods to be imported, to include mercury and mercury compounds in accordance with Annex A of the Minamata Convention.
Trade Ordinance	Goods containing mercury compounds could be listed under the Import Negative List which is provided for under the Trade Ordinance

Another important area for implementation of the Minamata Convention is the need for institutional strengthening. The implementation process would involve the need for a sound and proactive communication plan, and a carefully designed governance and accountability action plan. The Environmental Policy and Planning Division (EPPD) under the Ministry of Planning and Development is the Focal Point for Multilateral Environmental Agreements (MEAs) and issues related to the environment and, would therefore be responsible for the coordination and implementation of the Minamata Convention. This would have to be done in collaboration and cooperation with other designated agencies that have specific responsibility for various areas involved in the implementation of the Minamata Convention. A steering committee made up of representatives from key organizations should therefore be formed. This has been done as a National Working Group under the MIA Project and can be continued post-project with leadership by the EPPD.

Priority Areas for Consideration in the Implementation of the Minamata Convention

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

- Promotion of mercury-free alternative consumer products (which are already widespread on the market). For example, the use of Light Emitting Diodes (LEDs) may be encouraged instead of mercury-containing compact fluorescent lightbulbs (CFLs). Public awareness on the hazards of mercury and the benefits of using mercury-free alternatives should be enhanced to encourage a higher substitution rate.

- Development of proper separation methods for the disposal of mercury-added products both at the household consumer level and in the 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. A holistic approach for the establishment of suitable storage and disposal facilities in Trinidad and Tobago to manage mercury waste as well as other hazardous wastes from all sectors would prove beneficial in the overall environmentally sound management of waste in the Caribbean.

- Management of mercury releases from industrial processes through the implementation of further best available techniques/best environmental practices (BAT/BEP) measures, where necessary, to ensure that maximum control and reduction of mercury emissions and releases. The efficiencies of these measures should be continuously monitored and evaluated. It is also recommended that the locations for development of future industries/processes/disposal sites should be considered with respect to environmentally sensitive areas.

Introduction

Mercury in the Environment

Mercury (Hg) is a naturally occurring element in the Earth's crust. It is contained in several minerals and is commonly found as a reddish-brown compound called cinnabar; mercury sulphide. Mercury cannot be destroyed and once released from the crust and mobilized into the environment, it cycles between air, land and water. It may be eventually removed naturally by burial in deep ocean sediments. The biogeochemical cycle of transport and mobilization process of mercury is illustrated in Figure 3.

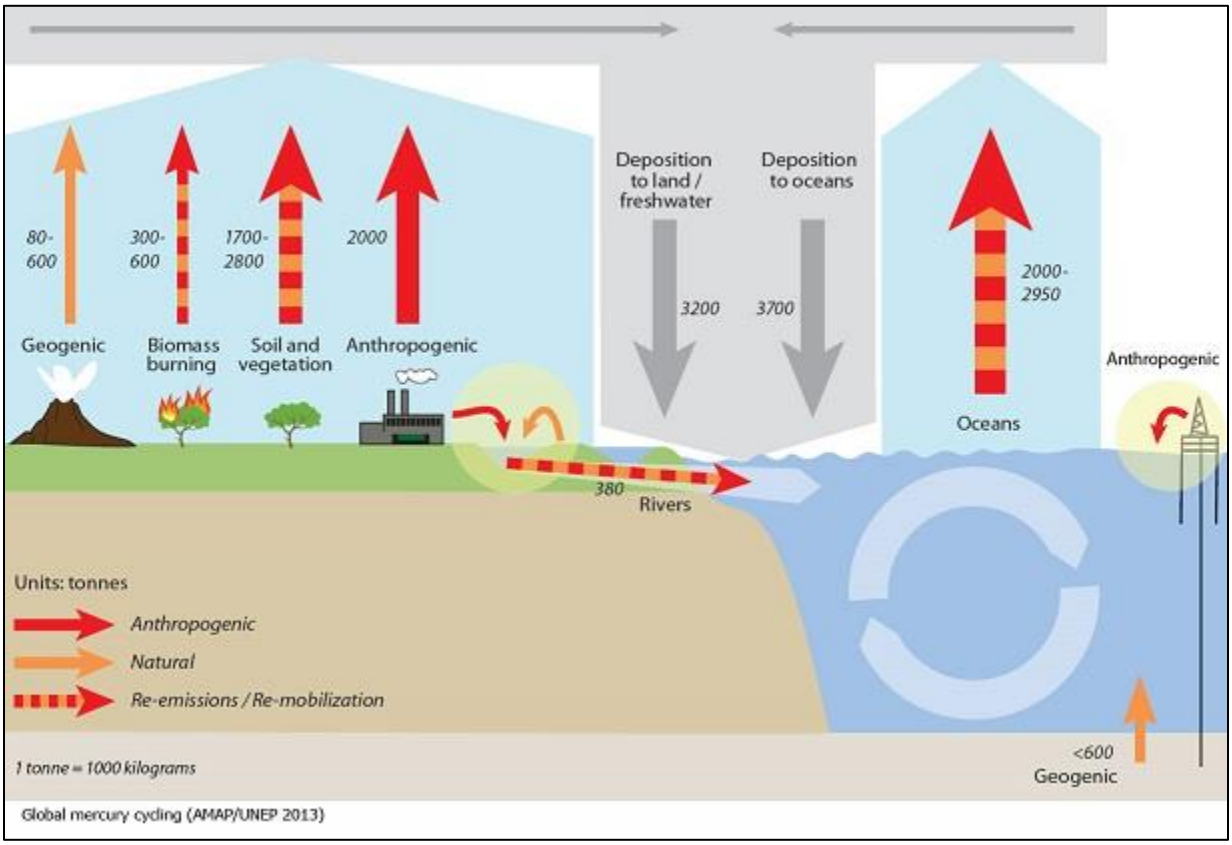


Figure 3: The Global Mercury Cycle (Values in tonnes of mercury)
(Source: AMAP/UNEP, 2013)

As a highly toxic chemical element, mercury is considered one of the top ten (10) chemicals of major public health concern (WHO, 2017). It can damage the central nervous system and affect numerous organs, resulting in neurological and behavioral

disorders. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches, and cognitive and motor dysfunction (UN Environment, 2017a). The severe effects caused by exposure to mercury in humans are largely seen in fetuses and young children due to their developing nervous systems.

Mercury can enter the human body through inhalation, direct contact with the skin or ingestion of contaminated food or water. Some common sources of exposure for humans include dental amalgam fillings, occupational exposure, skin-lightening creams and the consumption of fish. When mercury is deposited into water bodies, it is converted into methylmercury by the action of bacteria. This highly toxic organic form of mercury biomagnifies up the food web and exposure to humans is primarily through their diet of large predatory fish, which in general contain higher levels of methylmercury. This is discussed further in Section 4.1.1 of this report.

The different sources in which mercury is released into the environment can be grouped together as follows:

Natural Sources

Volcanic eruptions, weathering of mercury-containing rock materials, forest fires and ocean vents are some of the natural processes that release mercury from the earth's crust into the environment. Volcanic eruptions can release as much as 57 tonnes of mercury per year (t Hg/y), whilst degassing activities may release as much as 37.6 t Hg/y (Nriagu and Becker, 2003). Natural sources of mercury are not addressed under the Minamata Convention.

Anthropogenic Sources

Human activities, such as mining, combustion, production of metal from ores, the intentional use of mercury in products and processes and the re-mobilization of previous mercury releases have led to an increase in the mobilization of mercury into the environment. Anthropogenic sources can account for 30% of the mercury emissions in the atmosphere (AMAP/UNEP, 2013).

In 2013, UN Environment (formerly UNEP) with the Arctic Monitoring and Assessment Programme (AMAP) published the Global Mercury Assessment 2013 in which the major

sources of global mercury emissions were identified and assessed. It was found that artisanal and small-scale gold mining contributed the most to mercury emissions as large amounts of elemental mercury are often used in the process. Other key sources included coal combustion, industrial processes, and the use and disposal of mercury-added products, such as thermometers and compact fluorescent lightbulbs. The estimations for the top sources of mercury emissions are shown in Figure 4, with the estimated releases from Central America and the Caribbean highlighted in darker blue. From this region, the largest estimated source of mercury releases was due to artisanal and small-scale gold mining operations in countries, like Guyana and Suriname.

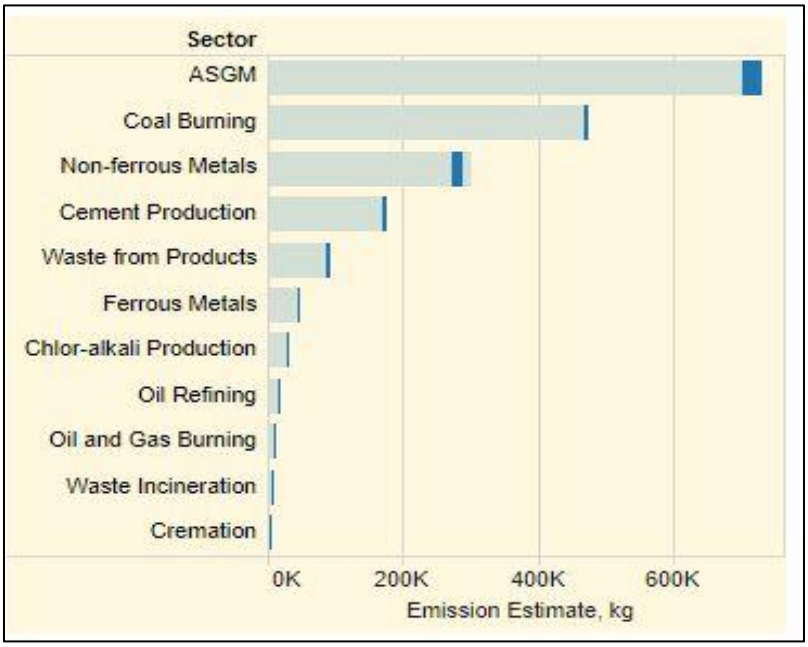


Figure 4: Estimations of global emissions (light blue) and Central American and Caribbean emissions (dark blue) of mercury based on 2010 data from various sources
(Source: AMAP/UNEP, 2013)

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. Article 1 of the Convention states the objective, which 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.

The Government of the Republic of Trinidad and Tobago (GoRTT) has indicated that while it supports the objective of the Minamata Convention, it is not yet in a position to ratify the Convention due to absence of information. In this regard, the GoRTT has indicated that a number of steps at a national level are being taken to become a Party to the Convention and it is anticipated that Trinidad and Tobago's current involvement in an ongoing MIA Project will enable them to do so. Throughout the Caribbean region, the countries that are Party to the Convention as of August, 2018 are Antigua and Barbuda, Cuba, Dominican Republic, Guyana, Jamaica, Saint Kitts and Nevis and Suriname.

Project Background

The project entitled, "Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, and Trinidad and Tobago)", or 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 conducting an inventory of mercury releases (and emissions)[1] in the respective countries. The MIA Project will assist the GoRTT in its decision-making when considering ratifying the Convention by providing a general overview of the current situation regarding mercury and its compounds in the country.

The MIA Project was funded by the Global Environment Facility (GEF), and the United Nations Environment (UN Environment; formerly the United Nations Environment Programme - UNEP) acted as the implementing agency. The Basel Convention Regional Centre for Training and Technology Transfer in the Caribbean (BCRC-Caribbean) served as the project executing agency. The Ministry of Planning 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 UN Environment 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 UN Environment Toolkit.

Development, Environmental Policy and Planning Division (EPPD) functioned as the national executing agency.

The development of an inventory of mercury releases in each participating country is a key component of the project, as it will inform participating countries of their national mercury situation and subsequently assist in applying action to increase their capacity in mercury management. The sharing of experiences and lessons learned throughout the project is also expected to be an important contribution to other countries in the region. The aim of the project is to be achieved through the six (6) components outlined in Table 2.

Table 2: Outline of the project components, outcomes and the expected outputs as stated in the MIA Project Document

Project Component	Project Component Outcome	Project Component Output
1. Establishment of Coordination Mechanism and organization of process	Participating countries make full use of enhanced existing structures and information available dealing with mercury management to guide ratification and early implementation of the Minamata Convention	Technical support provided for the establishment of National Coordination Mechanisms and organization of process for the management of mercury
2. Assessment of the national infrastructure and capacity for the management of mercury, including national legislation	Full understanding of comprehensive information on current infrastructure and regulation for mercury management enables participating countries to develop a sound roadmap for the implementation of a national legal framework for the ratification and early implementation of the Minamata Convention	Assessment prepared of the national infrastructure and capacity for the management of mercury, including national legislation

Project Component	Project Component Outcome	Project Component Output
3. Development of a mercury inventory using the UN Environment mercury Toolkit and strategies to identify and assess mercury contaminated sites	Enhanced understanding on mercury sources and releases facilitated the development of national priority actions	Mercury inventory developed using the UN Environment Mercury Toolkits and strategies to identify and assess mercury contaminated sites
4. Identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury	Improved understanding on national needs and gaps in mercury management and monitoring enables a better identification of future activities	Technical support provided for identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury
5. Preparation, validation of National MIA reports and implementation of awareness raising activities and dissemination of results	Participating countries and key stakeholders make full use of the MIA and related assessments leading to the ratification and early implementation of the Minamata Convention on Mercury	Technical support provided for preparation and validation of National MIA reports and implementation of awareness raising activities and dissemination of results
6. Information exchange, capacity building and knowledge generation	Enhanced communication, support and training facilitate the development of the Minamata Initial Assessment by participating countries and build the basis for future cooperation and regional approaches for mercury management	Information exchange undertaken and capacity building and knowledge generation for mercury management provided

In order to acquire information and develop a comprehensive national mercury management strategy for mercury releases, a stakeholder list (provided in Annex 1) was developed with assistance from representatives of the BCRC-Caribbean, the EPPD and Biodiversity Research Institute (BRI), the overall MIA Report Consultant. The stakeholders, which included professionals with experience in dealing with chemicals

and environmental issues, waste disposal, industrial activities, and representatives from relevant ministries, academic institutions and non-governmental organizations, were invited to the “National Inception Workshop and Mercury Inventory Toolkit Training” held on March 21, 2017.

Sector-specific questionnaires were then presented by BRI at the inception workshop using guidelines from the United Nations Institute for Training and Research (UNITAR). These questionnaires were distributed to representatives of each sector (Annex 2). Face-to-face interviews were also conducted where necessary.

The inventory was conducted with the use of the "Toolkit for Identification and Quantification of Mercury Releases" Level 2 (Toolkit), made available by the Chemicals Branch of the United Nations Environment (UN Environment Chemicals). The Toolkit is designed to produce a simple and standardised methodology and database to inform the national mercury inventory. It outlines a UN Environment-recommended procedure to facilitate the development of consistent and comparable source inventories. The steps involved included:

1. The identification of the main mercury source categories present in the country;
2. The refining of the mercury source categories identified into further sub-categories in order to identify the individual activities that potentially release mercury. Qualitative information on the activities was also gathered.
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 were calculated via equations and procedures specific to the source types identified.
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 are unavailable. Major data gaps will also be identified. These considerations are to assist in the interpretation of results and prioritisation of future actions.

This inventory was developed from February 2017 to November 2017 using data obtained primarily from the year 2016. In cases where 2016 data was unavailable estimations were used using data either from previous years or using default calculations provided by the Toolkit. Further details are provided in the respective sections in the report. The full inventory for Trinidad and Tobago is included as Annex 3.

Chapter 1: National Background Information

1.1 Country Profile

1.1.1 Geography and Population

The Republic of Trinidad and Tobago is a twin island state located at the southern end of the Caribbean island chain, just off the coast of South America. The country consists of two main islands - Trinidad and Tobago (Figure 5) and is located in both the northern and western hemispheres at 10° 2' and 11° 12' N latitude and 60° 30' and 61° 56' W longitude. Trinidad measures 4,768 km^2 in area with an average length of 80 km (Brereton et al, 2017). Tobago, the smaller of the two islands, is 30 km northeast of Trinidad and measures about 298 km^2 in area and is 41 km in length (GoRTT, 2017).

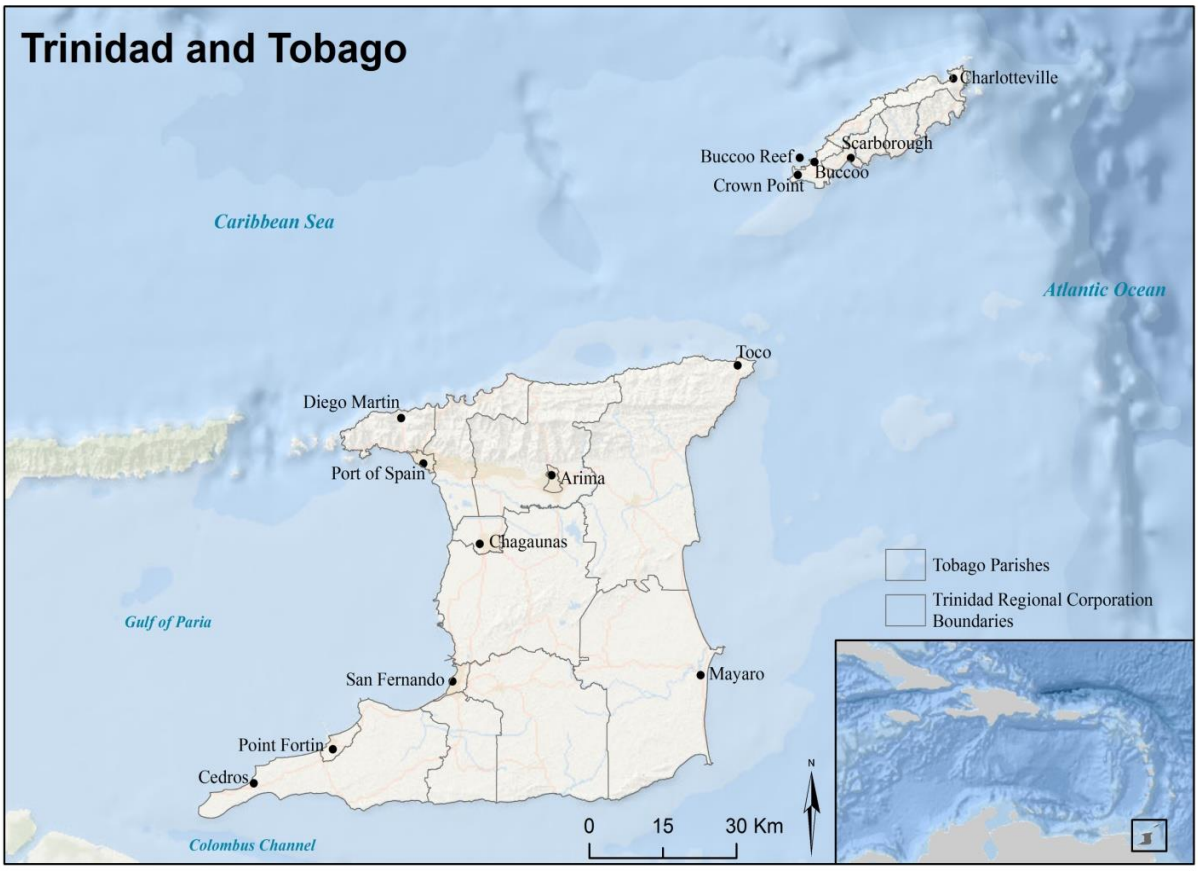


Figure 5: Map and location of Trinidad and Tobago (*SOURCE: BRI, 2017*)

According to the World Bank database the population for 2016 was 1,364,962.

1.1.2 Political, Legal and Economic Profile

Trinidad and Tobago is a Republic that operates in a bicameral parliamentary system based on the Westminster System. The parliament of Trinidad and Tobago consists of the President and two Houses, the Senate and the House of Representatives. All constituent parts of the Parliament are involved in the process of making a law. A proposal for a new law, or amendment to an existing law, can be initiated as a bill in either House. After a bill has passed both Houses, it is presented to the President for assent. If granted in the name of the President, the bill is converted into an Act of the Parliament of the Republic of Trinidad and Tobago, and it is part of the law of the land (Parliament of Trinidad and Tobago, 2015).

Trinidad is governed solely by the main government while Tobago is under the purview of the Tobago House of Assembly (THA) which is led by the leader of the majority party in the assembly (THA, 2015). The THA is comprised of two main arms, the Legislative arm and the Executive Arm. In addition to the normal local government functions, the THA handles many of the responsibilities of the central government, but has limited ability to collect taxes and impose local law or zoning regulations (GoRTT, 2017).

Trinidad and Tobago has a complex economy despite its small size as there are a number of sectors which provide income for the country including mineral extraction, cement production, manufacturing, agriculture and tourism. Trinidad depends heavily on domestic oil and gas resources to drive the economy. After 140 years of exploration and production in oil and gas, gas based production now exceeds oil production with regard to contribution to Gross Domestic Product. Although Tobago currently depends on tourism for their economic gain, there is a rise in efforts to diversify their economy with the development of the Cove Eco-Industrial and Business Park. The Eco-Industrial Park aims to provide a community of manufacturing and service businesses working together to improve their environment and economic performance, while ensuring that sustainable and sound management of resources are applied (InvestTT, 2017).

1.1.3 Environmental Overview

Trinidad and Tobago is listed as a Small Island Developing State (SIDS) and as such, faces specific social, economic and environmental vulnerabilities (UN-OHRLLS, 2017). Flooding, pollution of waterways, deforestation, climate change, loss of biodiversity and excessive soil erosion are just some of these environmental vulnerabilities which plague the country. In order to address its environmental problems, Trinidad and Tobago is already a party to a number of Multilateral Environmental Agreements (MEAs). These MEAs are coordinated by the MEA Unit of the EPPD and are categorized by Chemicals and Waste, Climate Change and Ozone, and Biodiversity. The Basel Convention directly applies to the responsible management of mercury waste. Table 3 below provides a listing of these international treaties.

Table 3: Multilateral Environmental Agreements of Trinidad and Tobago

Category	Multilateral Environmental Agreement	Date of Entry into Force
Chemicals and Waste	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	5 May, 1992
	Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade	24 February, 2004
	Stockholm Convention on Persistent Organic Pollutants (POPs)	17 May, 2004
Climate Change and Ozone	United Nations Framework Convention on Climate Change (UNFCCC), and its Kyoto Protocol	16 February, 2005
	Vienna Convention for the Protection of the Ozone Layer, and its Montreal Protocol	22 September, 1988

Category	Multilateral Environmental Agreement	Date of Entry into Force
Biodiversity	United Nations Convention on Biological Diversity (CBD), and its Cartagena Protocol on Biosafety	11 September, 2003
	United Nations Convention to Combat Desertification and Land Degradation	26 December, 1996
	Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	1 July, 1975
	Ramsar Convention on Wetlands	21 December, 1975

Previous research done on mercury releases in Trinidad and Tobago

From the period 2015 to 2016, the BCRC-Caribbean executed the Mercury Storage and Disposal Project in the Caribbean (Jamaica, Suriname and Trinidad and Tobago). This project sought to quantify mercury releases in Trinidad and Tobago utilizing the UNEP Toolkit for Identification and Quantification of Mercury Releases Level 1. The study found that in Trinidad and Tobago, the top three contributing sectors to mercury releases were the use and disposal of products containing mercury (47%); oil and gas production (26%); and cement production (17%). These results were based largely on assumptions and default calculations in the Level 1 Toolkit. Further details on some previous mercury research done in Trinidad and Tobago is detailed in Section 2.12 of this report.

Chapter 2: Mercury Inventory and Identification of Emissions and Resources

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

2.1.1 Mercury Release Source Types Present

At the National Project Inception Workshop held in March, 2017 in Trinidad and Tobago, stakeholders from the relevant sectors in the country were invited to confirm which source categories were present and required further assessment in the inventory. Their feedback was further assessed by the National Project Coordinator (Inventory) and the presence of the relevant sources was identified.

Table 4 shows the presence of the possible release sources under each category identified for Trinidad and Tobago. The positive identifications were then further quantified using the methods highlighted in the Toolkit for Identification and Quantification of Mercury Releases Level 2 (Toolkit). The categories identified as "absent" or "possible but not positively identified" were not discussed further in the report.

Table 4: Identification of mercury release sources in Trinidad and Tobago; sources present (Y), absent (N), and possible but not positively identified (?).

Source Category	Source Presence (Y/N/?)
Main category - Extraction and use of fuels/energy sources	
Coal combustion in power plants	**N**
Coal combustion in coal fired industrial boilers	**N**
Other coal use	**N**
Mineral oils - Extraction, refining and use	**Y**
Natural Gas - Extraction, refining and use	**Y**
Other fossil fuels – extraction and use	**N**
Biomass fired power and heat production	**N**

Source Category	Source Presence (Y/N/?)
Geothermal power production	**N**
Main category - Primary (virgin) metal production	
Mercury (primary) extraction and initial processing	**N**
Gold (and silver) extraction with mercury amalgamation processes	**N**
Zinc extraction and initial processing	**N**
Copper extraction and initial processing	**N**
Lead extraction and initial processing	**N**
Gold extraction and initial processing by methods other than mercury amalgamation	**N**
Aluminium extraction and initial processing	**N**
Other non-ferrous metals – extraction and processing	**N**
Primary ferrous metal production	**N**
Main category - Production of other minerals and materials with mercury impurities	
Cement production	**Y**
Pulp and paper production	**N**
Production of lime and light weight aggregates	**N**
Main category – Intentional use of mercury in industrial processes	
Chlor-alkali production with mercury-technology	**N**
VCM (vinyl-chloride-monomer) production with mercury catalyst	**N**
Acetaldehyde production with mercury catalyst	**N**
Other production of chemicals and polymers with mercury	**N**
Main category - Consumer products with intentional use of mercury	
Thermometers with mercury	**Y**
Electrical switches and relays with mercury	**Y**
Light sources with mercury	**Y**
Batteries with mercury	**Y**
Polyurethane with mercury catalysts	**?**
Biocides and pesticides with mercury	**N**
Paints with mercury	**N**
Pharmaceuticals for human and veterinary uses	**N**
Cosmetics and related products with mercury	**Y**
Main category - Other intentional products/process uses	
Dental mercury-amalgam fillings	**Y**

Source Category	Source Presence (Y/N/?)
Manometers and gauges with mercury	**Y**
Laboratory chemicals and equipment with mercury	**?**
Mercury metal use in religious rituals and folklore medicine	**N**
Miscellaneous product uses, mercury metal uses and other sources	**?**
Main category - Production of recycled metals	
Production of recycled mercury ("secondary production")	**N**
Production of recycled ferrous metals (iron and steel)	**N**
Production of other recycled metals	**N**
Main category – Waste incineration	
Incineration of municipal/general waste*	**Y**
Incineration of hazardous waste	**Y**
Incineration of medical waste	**Y**
Sewage sludge incineration	**N**
Informal waste burning	**Y**
Main category - Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	**Y**
Diffuse disposal under some control	**N**
Informal local disposals of industrial production waste	**N**
Informal dumping of general waste	**Y**
Waste water system/treatment	**Y**
Main category - Cremation and cemeteries	
Crematoria/cremation	**Y**
Cemeteries	**Y**

*Incineration of municipal/general waste refers to the controlled incineration of general waste (which may include mercury added products) by private waste management companies. This is detailed further in Section 2.7.1 of this report.

2.1.2 Summary of Estimated Mercury Inputs to Society

Mercury inputs to society refer to the mercury amounts made available for potential releases through the activities present in the country, as estimated in the Toolkit, and as shown in Table 5. This includes mercury mobilised via extraction and use of raw

materials; mercury intentionally used in products such as thermometers, blood pressure gauges, and fluorescent light bulbs; and mercury that can become available through the disposal of these products. Based on the estimated mercury inputs from each source category, the estimated mercury releases to various output pathways were calculated (as detailed in Section 2.1.3).

The inputs were calculated using input factors present in the Toolkit.

Note that the following source sub-categories made the largest contributions to mercury inputs to society:

- Natural gas – extraction, refining and use
- Electrical switches and relays with mercury
- Manometers and gauges with mercury

It is to be noted that while informal waste burning and waste water system/treatment did present higher input figures than electrical switches and manometers, both waste and waste water produced in the country do not represent original mercury inputs to society (with the exception of imported waste), as the origin of mercury in the waste comes from the mercury in products and materials.

Table 5: Summary of mercury inputs to society

Source Category	Estimated Hg Input, Kg Hg/y, by life cycle phase (as relevant)
	Use and Disposal
Source category: Extraction and use of fuels/energy sources	
Mineral oils - extraction, refining and use	**27.13**
Natural gas - extraction, refining and use	**3626.64**
Source category: Production of other minerals and materials with mercury impurities	
Cement production	**0.01**
Source category: Consumer products with intentional use of mercury	

Source Category	Estimated Hg Input, Kg Hg/y, by life cycle phase (as relevant)
	Use and Disposal
Thermometers with mercury	**5.55**
Electrical switches and relays with mercury	**168.40**
Light sources with mercury	**28.74**
Batteries with mercury	**36.16**
Cosmetics and related products with mercury[2]	**0.00**
Source category: Other intentional product/process use	
Dental mercury-amalgam fillings	**57.08**
Manometers and gauges with mercury	**144.32**
Source category: Waste incineration	
Incineration of municipal/general waste	**2.45**
Incineration of hazardous waste	**0.55**
Incineration of medical waste	**5.24**
Informal waste burning	**427.00**
Source category: Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	**37.88**
Informal dumping of general waste[3]	**0.00**
Waste water system/treatment[3]	**238.09**
Source category: Crematoria and cemeteries	
Crematoria/cremation	**28.98**
Cemeteries	**26.73**

[2] Identified as present, however, not enough information was available to quantify input.
[3] The estimated release to water include mercury amounts which have also been accounted for under each source category.
To avoid double counting release to water from waste water system/treatment have been subtracted automatically in the TOTALS.

2.1.3 Summary of Mercury Releases

The key mercury releases here are releases to air (the atmosphere), to water (marine and freshwater bodies, including via waste water systems), to land, to general waste, and to sector specific waste. An additional output pathway is "by-products and impurities" which designate mercury flows back into the market with by-products and products. Table 6 gives a more detailed description and definition of the output pathways.

Table 6: Description 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 the amount of coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example, from: • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources as small-scale gold mining, informally burned waste with fluorescent lamps, batteries, thermometers.
Water	Mercury releases to aquatic environments and to waste water systems: Point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example, releases from: • Wet flue cleaning systems from coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps.
Land	Mercury releases to soil, the terrestrial environment: General soil and ground water. For example, releases from: • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction; • Uncollected waste products dumped or buried informally; • Local unconfined releases from industry such as on site hazardous waste storage/burial; • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer); • Application on land, seeds or seedlings of pesticides with mercury compounds.
By-products and impurities	By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, for example: • Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants; • Sulphuric acid produced from desulphurization of flue gas (flue gas cleaning) in non-ferrous metal plants with trace concentrations of mercury; • Chlorine and sodium hydroxide produced with mercury-based chlor-alkali

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

An aggregated presentation of results for the output pathways of mercury release sources is presented in Figures 6 to 11 below. The description of the figures makes reference to source categories and their values found in *Table 5: Summary of mercury inputs to society.* Additional information on each category and sub-category is discussed in Section 2.3.

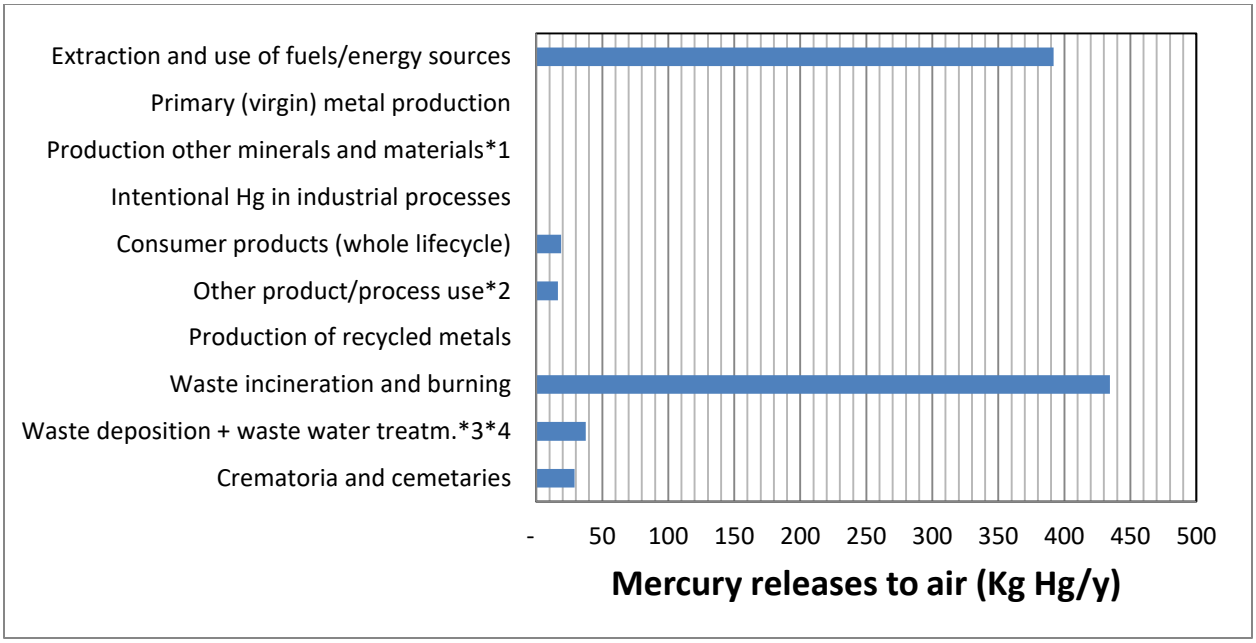


Figure 6: Estimated mercury releases to air in Trinidad and Tobago for 2016 (kg Hg/y)

Waste Incineration and burning had the largest value of mercury releases to air (Figure 6). This category included the sub category “Informal waste burning” which accounted for the majority of these releases.

The second largest emitter to air was generated from the extraction and use of fuels/energy sources. Primarily, this is from the extraction, refining and use of natural gas and mineral oils in which mercury is assumed to be a naturally occurring component in these raw materials.

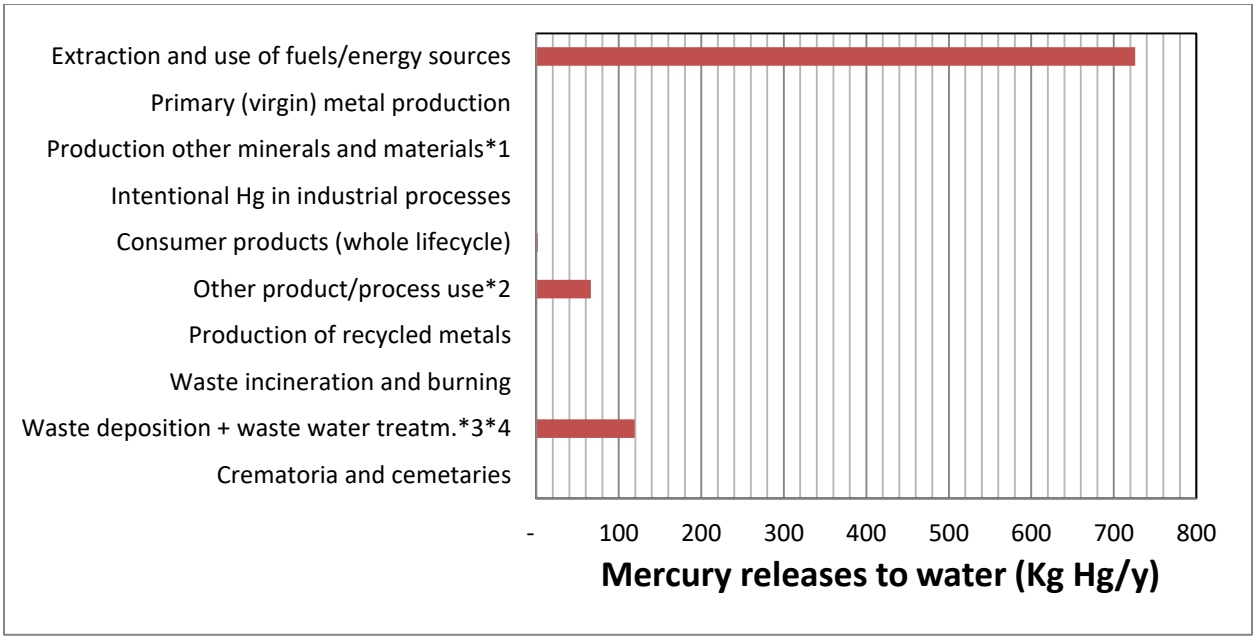


Figure 7: Estimated mercury releases to water in Trinidad and Tobago for 2016 (kg Hg/y)

The extraction and use of fuels/energy sources is the largest estimated emitter of mercury to water (Figure 7). This may be attributed to wastewater generated from the water extracted from the geological formations, as well as from chemicals used during exploration and well drilling. The mercury in the raw materials and chemicals used in some processes end up in this wastewater and therefore is a likely source of mercury releases. The second largest emitter to water is from the waste deposition and waste water treatment sector as mercury released from disposed products in landfills leach into the wastewater system. The other source of releases to water is from the improper disposal of dental amalgam waste and instruments containing mercury. In dental settings, amalgam waste is washed down sinks. Instruments containing mercury such as manometers and gauges may emit mercury to water if broken during use or when improperly disposed of in landfills.

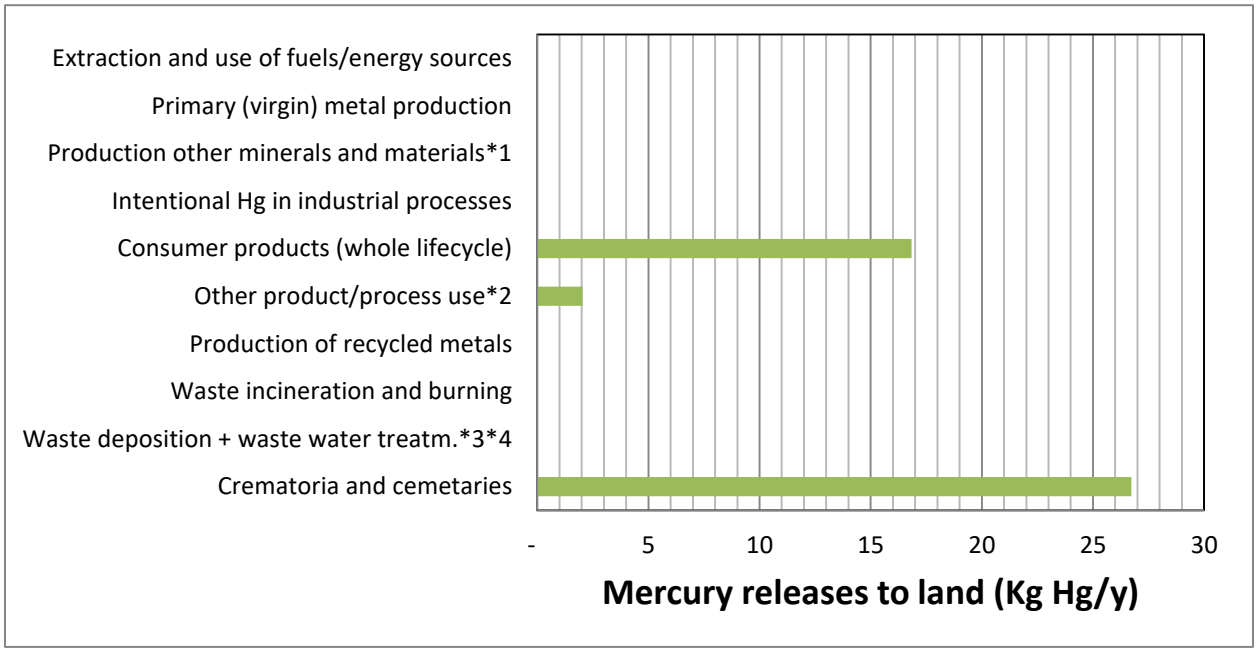


Figure 8: Estimated mercury releases to land in Trinidad and Tobago for 2016 (kg Hg/y)

Crematoria and cemeteries were determined to have the largest release of mercury to land (Figure 8). Cemeteries contribute to this source as corpses containing mercury, typically due to the presence of dental amalgam fillings, are buried in the ground and mercury may be released over time. The disposal of consumer products containing mercury such as thermometers, switches, light sources and batteries in landfills is also a major contributor to the release of mercury to the land.

The extraction and use of fuels is highlighted as the largest contributor to by-products and impurities, primarily from the extraction, refining and use of natural gas (Figure 9).

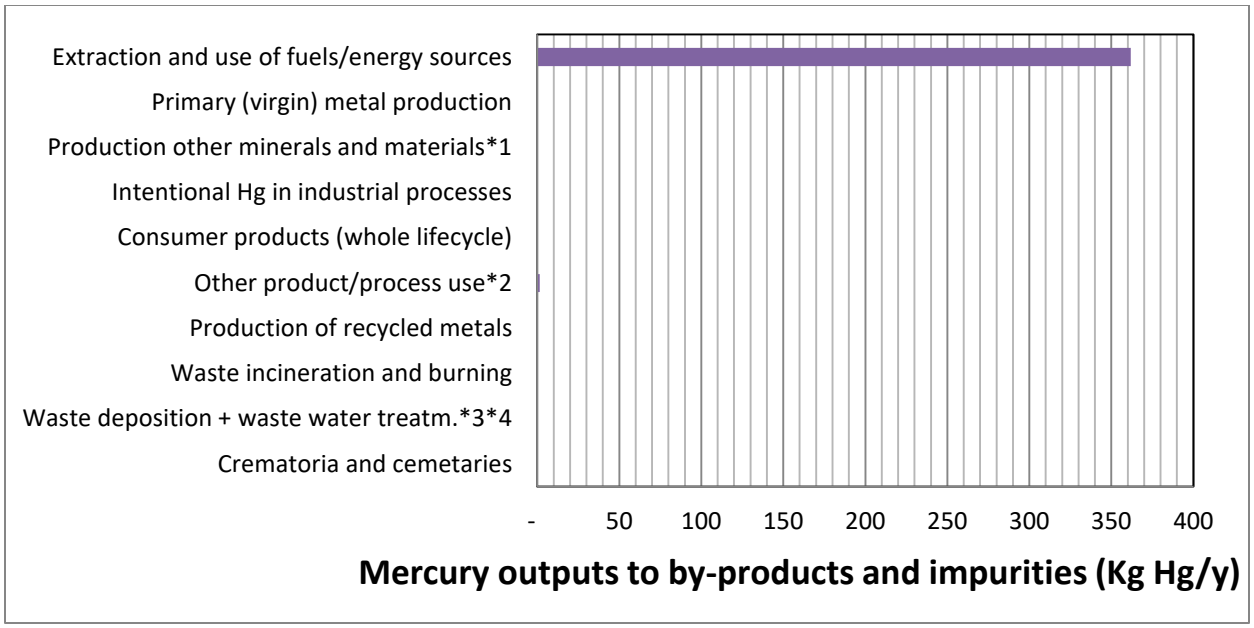


Figure 9: Estimated mercury outputs to by-products and impurities in Trinidad and Tobago for 2016 (kg Hg/y)

Consumer products (whole life cycle) resulted in the largest releases to general waste (Figure 10) as the majority of household items containing mercury are disposed of as municipal waste in Trinidad and Tobago.

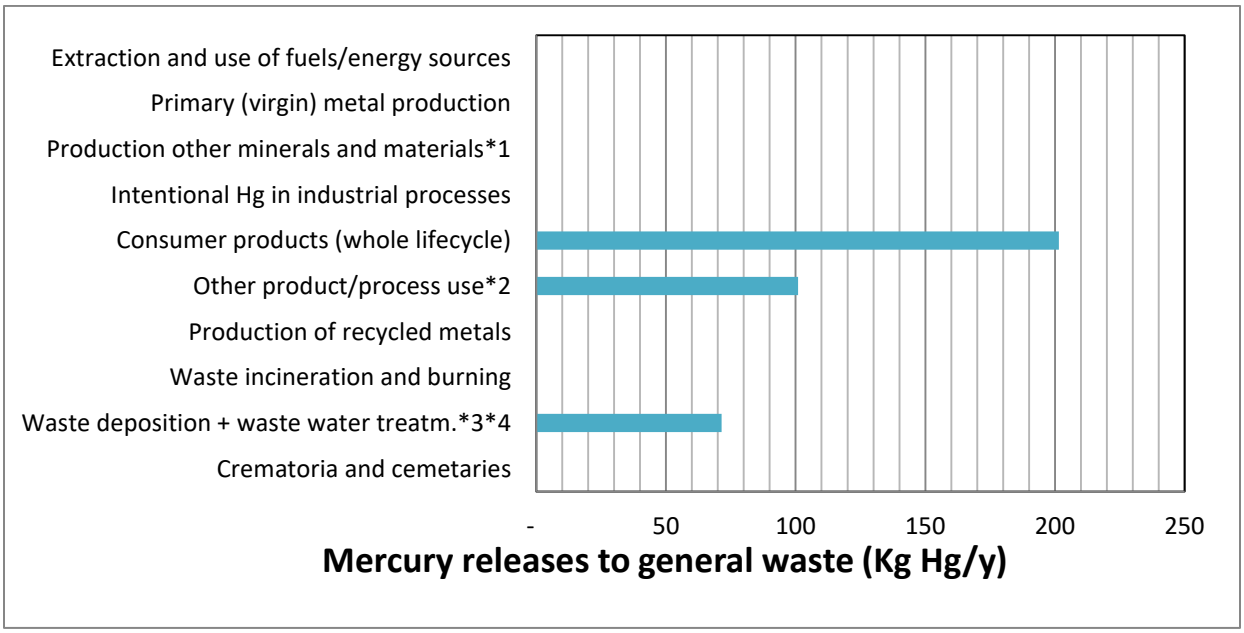


Figure 10: Estimated mercury releases to general waste in Trinidad and Tobago for 2016 (kg Hg/y)

Consumer products in this category refer to mercury containing thermometers, mercury containing batteries, light sources with mercury, electrical switches and relays and cosmetics that contain mercury. Dental amalgam fillings and manometers as categorized as other product/process uses also contribute significantly to releases to general waste as they are often disposed of as municipal waste.

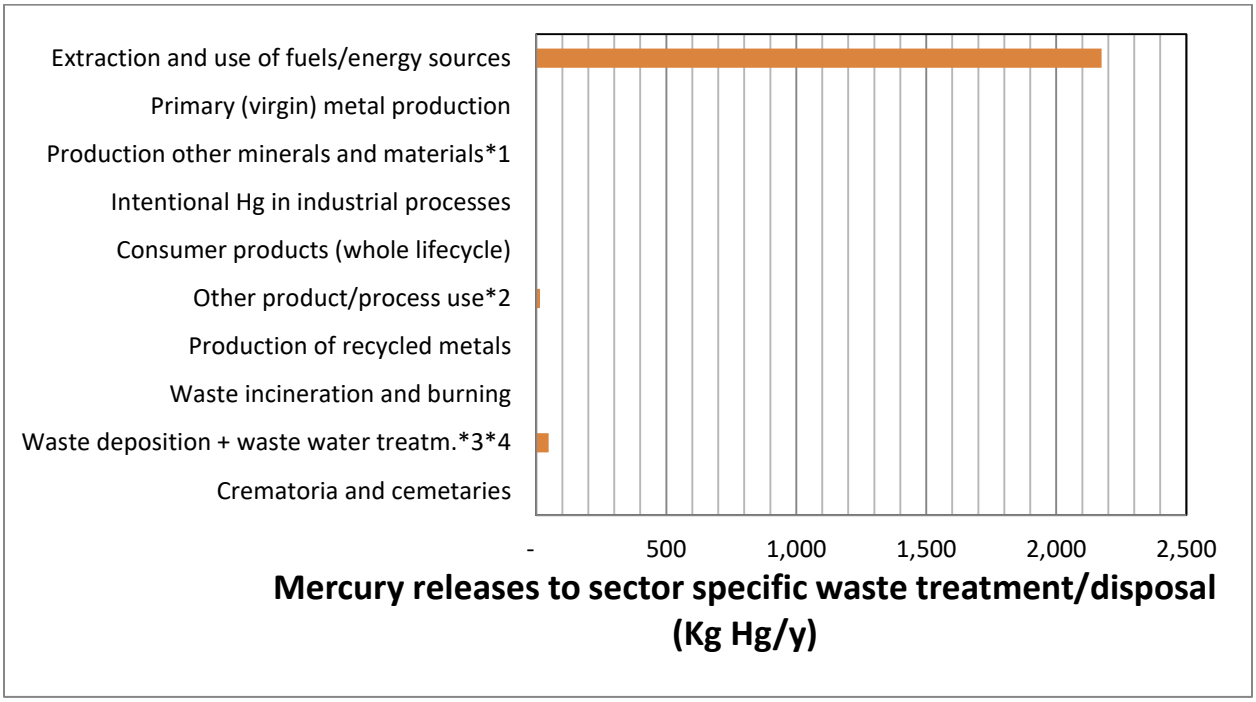


Figure 11: Estimated mercury releases to sector specific waste treatment/disposal in Trinidad and Tobago for 2016 (kg Hg/y)

Extraction and use of fuels was the largest estimated contributor to sector-specific treatment/disposal (Figure 11) as during the extraction and refining of fossil fuels, large amounts of mercury waste are assumed to be collected. Fossil fuel refineries in Trinidad and Tobago indicated that catalysts and scrubbers are used to prevent high emissions of heavy metals including mercury. In general, the waste stream collected from these filter control equipment are then sent for disposal or recycling. One company associated with the extraction and use of fossil fuels indicated that their solid waste stream produced during operations contain some mercury added products such as mercury containing batteries and compact fluorescent lightbulbs. However, these waste streams are collected and treated as appropriate before disposal.

***NOTES ON CHARTS**

**1 Includes production of cement, pulp and paper, lime and light weight aggregates.*

**2 Includes dental amalgam fillings, manometers and guages, lab chemicals and equipment, Hg used in religious rituals and folklore medicine, and miscellanous product uses.*

**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 data used in this chart.

**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 waste water system/treatment have been subtracted automatically in the data used in this chart.

Table 7 provides a summary of the mercury releases from the relevant sectors in Trinidad and Tobago based on the data provided in the Toolkit. The factors by which mercury releases were estimated to each output pathway are detailed further in the Summary of Inputs and Results sub-sections of each of the relevant source category sections of this report.

Table 7: Summary of mercury releases in Trinidad and Tobago for 2016

Source Category		Calculated Hg Output, kg/y					
	Total	**Air**	**Water**	**Land**	**By-products and impurities**	**General waste**	**Sector specific treatment/ disposal**
Source category: Extraction and use of fuels/energy sources							
Mineral oils - extraction, refining and use	**27.13**	22.59	2.03	0	0	0	2.51
Natural gas - extraction, refining and use	**3626.64**	369.35	724.84	0	361.92	0	2171.53
Source category: Production of other minerals and materials with mercury impurities							
Cement production	**0.01**	0.01	0	0	0	0	0
Source category: Consumer products with intentional use of mercury							
Thermometers with mercury	**5.55**	0.56	1.67	0	-	3.33	0
Electrical switches and relays with mercury	**168.40**	16.84	0	16.84	-	134.72	0
Light sources with mercury	**28.74**	1.44	0	0	-	27.30	0
Batteries with mercury	**36.16**	0	0	0	-	36.16	0
Cosmetics and related products with mercury	**0**	0	0	0	-	0	0
Source category: Other intentional product/process use							
Dental mercury-amalgam fillings (b	**57.08**	2.05	22.76	2.04	1.53	14.35	14.35
Manometers and gauges with mercury	**144.32**	14.43	43.30	0	0	86.59	0

Source category: Waste incineration[4]							
Incineration of municipal/general waste	**2.45**	2.21	0	0	0	0	0
Incineration of hazardous waste	**0.55**	0	0	0	0	0	0
Incineration of medical waste	**5.24**	4.72	0	0	0	0	0.52
Informal waste burning	**427.00**	427.00	0	0	0	0	0
Source category: Waste deposition/landfilling and waste water treatment							
Controlled landfills/deposits[5]	**37.88**	37.50	0	0	0	0	0
Informal dumping of general waste[5,5]	**0**	0	0	0	-	-	-
Waste water system/treatment[6]	**238.09**	0	119.05	0	0	71.43	47.62
Source category: Crematoria and cemeteries							
Crematoria/cremation	**28.98**	28.98	0	0	-	0	0
Cemeteries	**26.73**	0	0	26.73	-	0	0
SUM OF QUANTIFIED INPUTS AND RELEASES[5,6,7,7]	**4435.13**	**928.15**	**793.97**	**45.61**	**363.46**	**373.88**	**2236.83**

[4] To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration sources, waste deposition and informal dumping is included in the total for mercury inputs. These 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of this Toolkit.

[5] 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.

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

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

2.1.4 Summary of Mercury Stockpiles, and Supply and Trade

Under Article 3 of the Minamata Convention, provisions are in place for Parties to endeavour to identify stocks of mercury or mercury compounds (not including mercury added products) that are in excess of 50 metric tons, as well as sources of mercury supply generating stocks exceeding 10 metric tons per year located within its territory.

If any such stockpiles are identified, Article 10 of the Convention regarding environmentally sound interim storage of mercury, other than waste mercury, would also apply.

At the time of the inventory, it was determined that no such stockpiles or supplies were present in Trinidad and Tobago.

2.2 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, such as those typically at oil and gas facilities that lead to deposition on site as well as possible inadequate disposal of mercury-contaminated materials in landfills. In Trinidad and Tobago, landfills and their surrounding areas are considered to be mercury hot spots as mercury added instruments such as medical thermometers or more commonly, compact fluorescent lightbulbs (CFLs) are mixed with municipal waste from most households and disposed of at these landfills.

In order to assist Trinidad and Tobago in the identification of contaminated sites, BRI collected national-scale spatial data on the location of waste disposal sites. Data was also obtained on ecosystem types, major watersheds and topography. This data was used to develop a model to improve the understanding of areas potentially sensitive to mercury contamination. Identifying these spatial patterns in sensitivity is important for improving targeting for monitoring and mitigation efforts. Due to the characteristics of mercury contamination in the environment, watershed and catchment areas were used as the units of analysis and examined in Trinidad and Tobago (Burton and Buck, 2017).

The predictor variables accepted and used to analyze mercury sensitivity by watershed are shown in Table 8.

Table 8: The Predictor Variables Accepted and Used to Analyse Mercury Sensitivity by Watershed for Trinidad and Tobago (X= Present)

Parameter	Predictor Variable	Trinidad	Tobago
Percent Coverage	Mangrove	X	X
	Forest Cover	X	X
	Agriculture	X	X
	Rice	X	
	Wetlands		
	Waterbodies		
	Ponds, Lakes, Swamps		
	Ponds, Swamps	X	
Occurrence Data	Wetlands		
	Landfills and disposal sites	X	X
	Wastewater treatment plants	X	X
	Bauxite plants		

After a ranking was assigned to each watershed for each predictor variable available in Trinidad and Tobago, the rankings were summed across each watershed or catchment. An increasing number of assigned total points indicate the presence of a set of variables that combine to expose the watershed to increased sensitivity to mercury contamination. In order to compare watersheds with varying numbers of predictor variables, the results were normalized by dividing the total cumulative points of each watershed by the maximum number of points that could be awarded for each individual watershed to create a final proportional ranking (Burton and Buck, 2017). Figure 12 shows the results of this study.

The results of the analysis show that the watersheds in the south-west of Trinidad are the most sensitive to mercury by a ranking of 0.8 - 1.0. In Tobago, watershed mercury sensitivity was highest in the south-west of the island at 0.6 - 0.8.

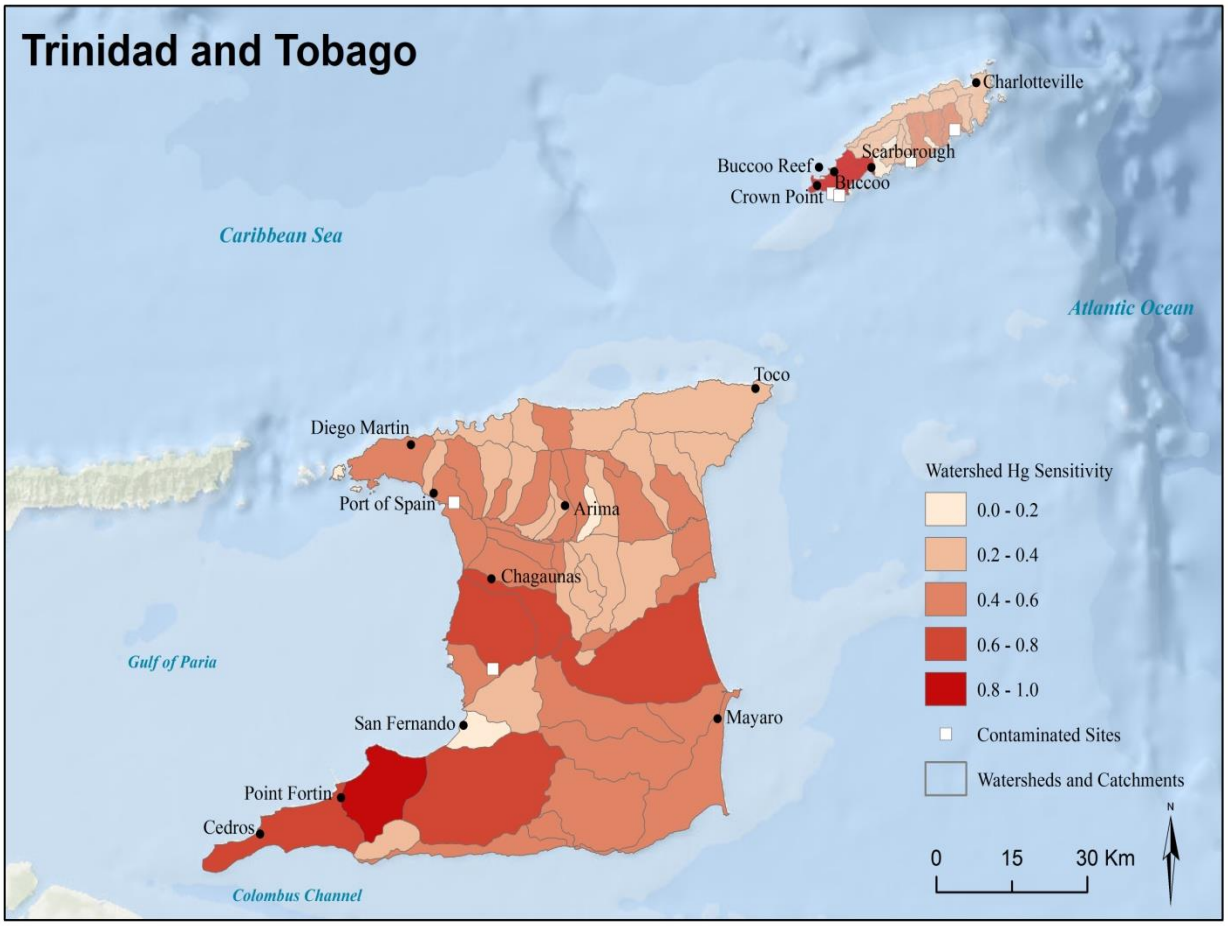


Figure 12: Trinidad and Tobago watershed mercury sensitivity analysis results (*Source: BRI, 2017*)

To further optimize the analysis, the presence and location of potential sources of mercury should be verified to observe the correlation between contaminated sites and sources of mercury releases. To do this, relevant authorities in Trinidad and Tobago should confirm the status and locations of all oil and gas facilities, disposal sites and informal dumping sites. For instance, the location of oil and gas fields as identified in Figure 13 in Trinidad appear to have a strong correlation with the watershed sensitivity ranking for that island.

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

For over one hundred years, Trinidad and Tobago has been reliant on oil and gas exploration, development, and extraction to drive the economy. According to the Ministry of Energy and Energy Industries (MEEI), the country is the largest producer of oil and natural gas in the Caribbean region. Although the energy sector became more focused on natural gas in the 1990s, oil extraction and refining still remains prominent (Figure 13). The state-owned Petroleum Company of Trinidad and Tobago Limited (PETROTRIN), located on the south-west coast of Trinidad, serves as the only oil refinery on the island.

2.3.1 Extraction, Refining and Use of Mineral Oil

Crude oil contains trace amounts of natural mercury impurities which are mobilized into the air, land and water during extraction and use. Mercury can also be released through refinery products or by-products and various process wastes and sludge. The concentration of mercury in the oil being extracted is dependent on the country's geology. Limited information however, was found on the geology of Trinidad and Tobago with regards to mercury concentrations. In addition to the naturally occurring mercury impurities in oil, mercury is often used in the extraction process through the use of certain types of drilling mud (liquid drilling fluid) and subsequently released to various pathways. Data for oil production was obtained from the MEEI Consolidated Bulletin 2016. In 2016 the amount of oil extracted was 2,992,253 tonnes per year.

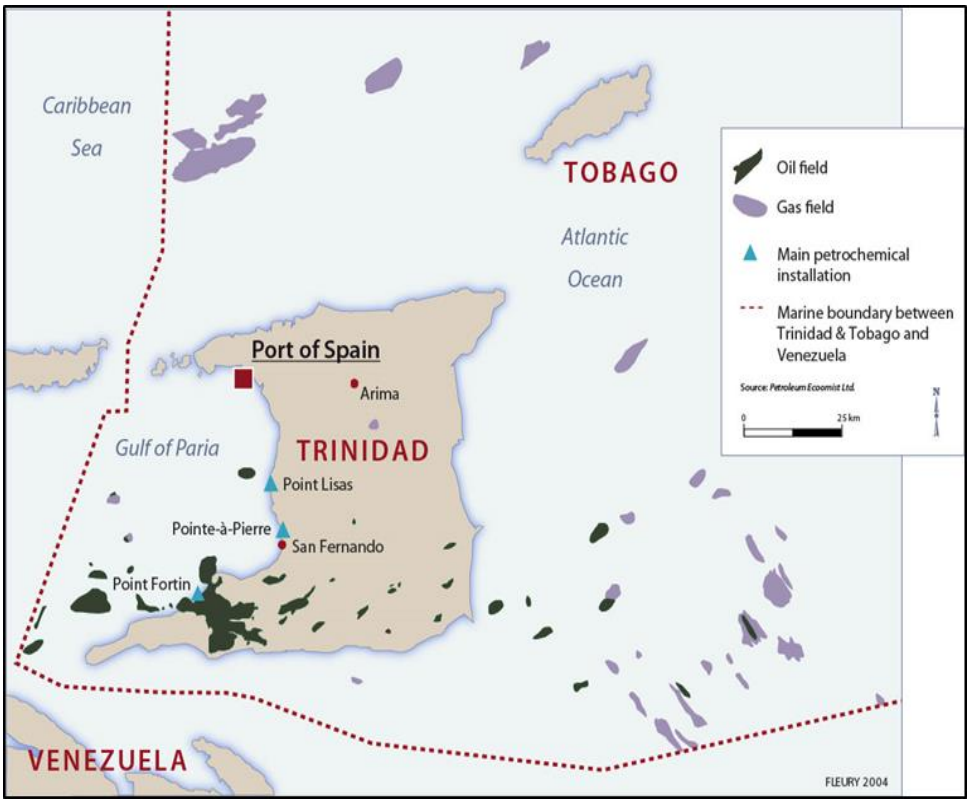


Figure 13: Location of oil and gas fields in Trinidad and Tobago (Caribbean Atlas, 2016)

The only oil refinery in Trinidad and Tobago, PETROTRIN, was contacted for information on their mercury management practices. The company indicated that catalysts are used within the reactors on their Continuous Catalyst Regeneration Complex, Isomerization Complex, Reformer Area and the Hydrocracking Train. None of the catalysts, however, spent or otherwise, have ever been tested for mercury[8], since it has not been present in any detectable quantity in the crude oil being treated. This is in contrast to other heavy metals such as cadmium, arsenic and lead which are expected in the feed and thus tested for in the catalyst. PETROTRIN indicated that the agencies contracted to dispose of the catalysts over the years have not reported any mercury.

The refining process of the crude oil involves the removal of impurities in the raw material, namely nitrogen, sulphur and metals and then the separation by distillation and cracking into a number of refined products including gasoline, diesel and kerosene

[8] At the time of the inventory, it was assumed that this referred to all forms of mercury, however this would need to be further verified in future assessments.

(UNEP 2015b). Due to the sulphur-rich environment commonly found in most refinery processes, mercury often becomes unstable and forms mercury sulphide as the two elements have such a strong affinity (IPIECA, 2014).

2.3.2 Natural Gas Production and Use

In Trinidad and Tobago, natural gas is typically extracted offshore and processed onshore. Natural gas, like many other natural materials, contains small amounts of mercury which are released into the biosphere during extraction, refining and combustion. The natural gas production process begins with the extraction through wells drilled into the ground, followed by a treatment process to remove impurities, then transportation to power plants, and finally the combustion process to generate electricity (UN Environment, 2017a). Natural gas in Trinidad and Tobago is used for power generation, heating, cooking, fuel and as a chemical feedstock in the manufacture of plastics and other commercially important organic chemicals. The electrical sector in Trinidad and Tobago is powered entirely by natural gas as the fuel source. The Trinidad and Tobago Electricity Commission (T&TEC) is the sole distributor responsible for the supply of electrical services in the country and generation is provided by Independent Power Producers (MEEI, 2017).

With regard to power production, the process begins as the natural gas is extracted and treated to remove various impurities, including mercury, using specific filter equipment. Most of the mercury in the raw natural gas may be removed during the extraction and/or refining process, including during the removal of hydrogen sulphide (Pirrone et al., 2001). In the local context, this occurs at two (2) of the gas processing companies detailed below. Due to the Petroleum Act and environmental legislations such as the Certificate of Environmental Clearance, this offshore drilling process is highly regulated and some Best Available Techniques (BAT) and Best Environmental Practices (BEP) are already in place. The mercury residues from the gas cleaning filters are recovered in some countries and marketed as a by-product while in other countries these residues are transported and treated as hazardous waste.



Atlantic LNG of Trinidad and Tobago is the only natural gas liquefier in the country. They are one of the world's largest suppliers of natural gas and when contacted for this inventory, they indicated that their mercury waste is collected and treated as hazardous waste. In all of their measurements, the mercury concentrations were very low and at times below a detectable limit.

Phoenix Park Gas Processors Limited (PPGPL) is a gas processor present in the country. According to the MEEI (2016), PPGPL's natural gas liquid complex is one of the largest facilities in the western hemisphere. During stakeholder consultations for this inventory, PPGPL indicated that in all of their measurements, the mercury concentrations were very low and at times below a detectable limit. The processed natural gas supplied by these companies is transferred to the various petrochemical plants and power generation facilities in the country.

Data for natural gas production and refinement was obtained from the MEEI 2016 Consolidated Bulletin. It should be noted that for some companies, only preliminary values for natural gas production were given. The amount of natural gas extracted and refined in Trinidad and Tobago in 2016 was estimated to be 36,192,148,488 Nm^3/y.

Summary of Inputs and Results

As previously mentioned, the input data for this source category was determined using the MEEI 2016 Consolidated Bulletin. The value used for 'Extraction of Mineral Oil' was determined by subtracting the value given in the bulletin for the average 'Crude Oil and Condensate Production' from the average 'Condensate Production (only)' value, resulting in a 2016 estimate of 60,451 barrels of oil per day (bopd). An online conversion tool[9] was used to convert this value to 2,992,252 t/y which was entered into the Toolkit spreadsheet. The tool was also used to convert the average 'PETROTRIN Pointe-a-Pierre Refinery Throughput in 2016' estimate (148,251 bopd) to the value entered into the Toolkit for the 'Production of Mineral Oil' (seen in Table 9).

[9] Conversion Tool used available at: http://www.cmegroup.com/tools-information/calc_crude.html

Using the Consolidated Bulletin, the average totals for 'Natural Gas Production by Company in 2016' and 'Natural Gas Utilized by Sector in 2016' were converted from Millions of Standard Cubic Feet per day (MMSCF/D) to Normal Cubic Meters per year (Nm^3/y) using an online converter tool[10] and input in the Toolkit for the respective sectors: 'Production of Natural Gas' and 'Use of Pipeline Gas (Consumer Quality)'.

The following table (Table 9) summarizes the mercury inputs and releases to Trinidad and Tobago from the extraction and use of fuels/energy sources. The input factors and output distribution factors for each phase shown in Table 9 were provided in the Toolkit and based on desktop studies conducted and limited data bases (UN Environment, 2017a). Based on stakeholder feedback obtained during this inventory on the standards and BAT/BEP in place in the local industry, it can be inferred that the mercury releases indicated in Table 9 are over-estimations. Actual data on the mercury levels in the oil and gas extracted/refined/used locally should be collected in order to provide more accurate estimates of the releases from this sector.

Table 9: Analysis of mercury input and output factors for mineral oil and natural gas refining in Trinidad and Tobago, 2016

	Units	Extraction of Mineral Oil	Production of Mineral Oil	Production of Natural Gas	Use of Pipeline Gas (Consumer Quality)
Activity rate	t oil/y	2,992,253	7,382,212	-	-
	Nm^3 gas/y	-	-	36,192,148,488	33,766,284,960
Input factor for phase	mg Hg/t oil	3.4	3.4	-	-
	µg Hg/Nm^3 gas	-	-	100	0.22
Calculated input to phase	kg Hg/y	10.17	25.10	3619.21	7.43
Output distribution factors for phase:					
- Air	N/A	-	0.9	0.1	1
- Water	N/A	0.2	-	0.2	-
- Land	-	-	-	-	-
- Products	N/A	-	-	0.1	-
- General waste treatment	-	-	-	-	-
- Sector specific waste treatment	N/A	-	0.1	0.6	-

[10] Conversion Tool used available at: http://www.traditionaloven.com/conversions_of_measures/gas_flows_converter_tool.html

Calculated outputs/releases to:					
- Air	kg Hg/y	-	22.59	361.92	7.43
- Water	kg Hg/y	2.03	-	723.84	-
- Land	-	-	-	-	-
- Products	kg Hg/y	-	-	361.92	-
- General waste treatment	-	-	-	-	-
- Sector specific waste treatment	kg Hg/y	-	2.51	2171.53	-



2.4 Data and Inventory on Production of Minerals and Materials with Mercury Impurities

Raw materials such as lime, coal, clay and wood, which are used to produce cement, pulp and paper, and lime and light weight aggregates, can contain trace amounts of mercury. During various mechanical, chemical and thermal processes, this mercury can be released to the environment.

Aside from cement production, no other material or mineral with mercury impurities is produced in Trinidad and Tobago. It can be noted that in March 2016, ArcelorMittal, a multinational steel manufacturing company, closed down their steel plant in Point Lisas, Trinidad.

2.4.1 Cement Production

Raw materials as well as fuels used in cement production typically contain small amounts of mercury. Cement production in Trinidad and Tobago is conducted by Trinidad Cement Limited (TCL). TCL's products include Premium Plus Cement, Ordinary Portland Cement, Type II Cement, Class G HSR Cement and Sulphate Resistant Cement. TCL also exports its products to various Caribbean islands.

Cement production involves the excavation and crushing of limestone. Once crushed, water, iron oxide and sand are added to form a slurry which is then put in an oven. The heat from the oven transforms it to clinker (large, glassy, hot cinders). The clinker is then sent to a grinding ball mill for grinding (TCL, 2014). Mercury releases primarily occur in the clinker production stage (UN Environment, 2017a). Cement clinker production facilities are therefore listed in Annex D of the Minamata Convention on Mercury, as point sources of emissions of mercury and mercury compounds to the atmosphere and, are subject to the obligations listed in Article 8 of the Convention concerning the management of emissions.

According to TCL, Trinidad and Tobago produced 721,213 tonnes of cement in 2016. Locally supplied natural gas is currently the main source of fuel used in the cement kilns. The company uses an electrostatic precipitator and a multicyclone (dust collector)

to control and recycle particulate emissions on the cement kiln. In addition, baghouse filters are used to capture and recycle particulate emissions in the transport and grinding/milling of materials. TCL stated that their emission controls have not indicated the presence of mercury.

Summary of Inputs and Results

The following table (Table 10) summarizes the mercury inputs and releases to Trinidad and Tobago from cement production.

Table 10: Analysis of mercury input and output factors for cement production in Trinidad and Tobago, 2016

	Cement Production
Activity rate	721,213 t/y
Input factor for phase	0.00002g Hg/ t cement produced with natural gas fuel
Calculated input to phase	0.01 kg Hg/y
Calculated outputs/releases to:	
- Air	0.01 kg Hg/y
- Water	-
- Land	-
- Products	-
- General waste treatment	-
- Sector specific waste treatment	-

In a previous mercury releases inventory report completed for Trinidad and Tobago in December 2016 under the project, “Mercury Storage and Disposal in the Caribbean (Jamaica, Suriname and Trinidad and Tobago)”, the Inventory Level 1 Toolkit was used and it was determined that cement production accounted for 17% of the country’s total mercury releases (BCRC-Caribbean, 2016). This was calculated based on the assumption that co-incineration of waste and the use of high mercury content fuels were used in the cement kiln. Under the current inventory, the releases estimated were based on the information obtained from TCL that indicated that natural gas was the sole fuel source used. Based on this, the estimated mercury releases from this sector were determined to be negligible.

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

The intentional use of mercury in certain products can result in mercury releases during the manufacture, use, and end-of-life disposal of these items. Reducing and eventually eliminating the use of consumer products containing mercury that can be released throughout their life-cycle is a priority area to successfully implement the Minamata Convention on Mercury. Under the Convention, Parties must phase out, by 2020, the manufacture, import and export of certain mercury-added products listed under Annex A, Part I. These products include electrical switches and relays, batteries, lighting devices, medical devices and cosmetics. Details on the types of products and their exemptions are also listed in the Annex.

For this category, import data from Trinidad and Tobago's Customs and Excise Division was used to estimate mercury containing instruments. The data for thermometers did not distinguish amongst mercury containing thermometers, alcohol based thermometers or digital thermometers, so assumptions were made.

2.5.1 Thermometers Containing Mercury

Historically, mercury has been used in thermometers because of its low vapour pressure which makes it ideal for detecting small changes in temperature and facilitating measurements within a large range of temperatures. Mercury thermometers have been used throughout Trinidad and Tobago predominantly as medical thermometers, ambient air temperature thermometers, in chemical laboratories, and in controls of some machines (large diesel engines) and industrial equipment. These mercury thermometers may contain between about 0.6 and several 100 grams of mercury per unit, depending on the use (COWI, 2002).

According to retailers contacted during this inventory, there has been a decline in the sale of the mercury thermometers as digital or alcohol containing alternatives have been provided. A total of ten (10) popular retailers were contacted to gather information on



mercury containing thermometers. These retailers consisted of major pharmacies in Victoria County of Trinidad and included the towns of Gasparillo, Marabella and Vistabella, and the city of San Fernando. The retailers explained that medical thermometers are not a popular product as the public often use their discretion in determining if they are ill. Additionally, hospitals and nursing homes are utilizing digital thermometers, making the market for mercury containing thermometers in this field almost non-existent. It should be noted that mercury thermometers are still utilized in a number of schools as the curriculum dictates that students understand the movement and expansion of mercury.

Data acquired from the Customs and Excise Division was aggregated with other data on mercury-free thermometers and medical equipment. For the year 2016, the total aggregated devices imported were 27,750 and based on discussions with retailers, it was determined that approximately 20% of the total thermometers in stock contained mercury, thus resulting in an estimate of 5,550 thermometers containing mercury.

Summary of Inputs and Results

The following table (Table 11) summarizes the mercury inputs and releases to Trinidad and Tobago from the use and disposal of thermometers.

Table 11: Analysis of mercury input and output factors for mercury thermometers in Trinidad and Tobago, 2016

Thermometers with Mercury	Use and Disposal
Activity rate	5550 items /year
Input factor for phase	1 g Hg/item
Calculated input to phase	5.55 kg Hg/y
Calculated outputs/releases to:	
- Air	0.56 kg Hg/y
- Water	1.67 kg Hg/y
- Land	-
- Products	-
- General waste treatment	3.33 kg Hg/y
- Sector specific waste treatment	-

2.5.2 Electrical Switches and Relays with Mercury

Elemental mercury was a commonly used component of electrical switches and relays found in numerous electrical apparatus, but in the last two (2) decades, mercury-free switches and relays have become more popular globally. However, due to the long service life of most switches and relays, mercury-containing end-of-life electrical switches and relays are still expected to be present in waste for many years (UN Environment, 2017a).

The most common use of elemental mercury in the manufacture of electrical equipment is in tilt switches or “silent” switches, which are used for silent electric wall switches, convenience lights (such as those used in car trunks when it is opened), Antilock Braking Systems and active ride-control systems in vehicles; as well as thermostats for air conditioning and ventilation units.

Relays, which are electrically controlled switches, also use mercury as a component. Some mercury-containing relays include mercury displacement relays, mercury wetted reed relays, and mercury contact relays. Although the mercury relays may be widely used, the total mercury consumption with relays of electronics has been relatively small compared to the mercury switches.

Mercury-containing switches have a long life span and can remain in circulation for 10-50 years (Jasinski, 1994). Their disposal typically occurs when buildings are renovated or demolished. Switches and relays in cars are usually disposed of when the equipment or cars are discarded. The number of switches and relays disposed of today reflects the number consumed/produced 15-20 years ago so the electrification rate used in the inventory was calculated using the percentage of Trinidad and Tobago’s population with access to electricity in the year 2000. This value was inserted as the input factor, while the activity rate data was the population of Trinidad and Tobago for that same year.

Summary of Inputs and Results

The following table (Table 12) summarizes the mercury inputs and releases to Trinidad and Tobago from the use and disposal of electrical switches and relays.



Table 12: Analysis of mercury input and output factors for electrical switches and relays in Trinidad and Tobago, 2016

Electrical Switches and Relays with Mercury	Use and Disposal
Activity rate	1,268,000 inhabitants (for the year 2000)
Input factor for phase	0.14 g Hg/y
Calculate input to phase	168.40 kg Hg/y
Calculated outputs/releases to:	
- Air	16.84 kg Hg/y
- Water	-
- Land	16.84 kg Hg/y
- Products	-
- General waste treatment	134.72 kg Hg/y
- Sector specific waste treatment	-

2.5.3 Light Sources with Mercury

Mercury is used in small amounts in a number of different types of discharge lamps. Fluorescent tubes and compact fluorescent lightbulbs (CFLs) are the most common examples (UNEP, 2017a). Mercury is also used in metal mercury vapour and argon lamps produced for commercial or municipal use such as in street lighting. Although many producers have become aware of the risks associated with mercury use and have reduced the concentration of mercury used in their production, lamps with high concentrations still exist on the market. These lamps are thought to be sold in large quantities as the prices are generally lower compared to the ones with reduced mercury (COWI, 2002).

Fluorescent lightbulbs (single CFLs and double end tubes)

Fluorescent tubes use mercury to generate light as the mercury acts as multi-photon source. An electric current “excites” mercury vapour in the lamp and produces a short-wave ultraviolet light causing the coating of phosphor on the inside of the lamp to glow. Elemental mercury is introduced into the tube when it is manufactured. The mercury

loses its efficacy over time so at least 50 micrograms of mercury is required per lamp (Dunmire et al., 2003). CFLs typically have a five (5) year life span in residential use.

According to the Customs and Excise Division, 1,068,108 CFLs were imported into the country in 2016 and over 1,000,000 CFLs were imported in 2015. Customs and Excise data also indicated that 639,867 double ended fluorescent tubes were imported in 2016. It is expected that these bulbs will eventually be disposed of in landfills as most households tend to mix them with municipal waste. Breakage eventually occurs and the mercury from the bulbs enters the surrounding environment.

Mercury vapour lamps

It should be noted that T&TEC indicated that there were 160,000 accumulated mercury vapour lamps awaiting disposal. Such lamps contain an estimated mercury concentration between 25 mg to 200 mg per lamp.

Metal halide lamps (sodium and mercury)

Customs and Excise data revealed that 98,113 discharge lamps were imported in the year 2016. However, there was no distinction on whether the metal halide lamps contained sodium or mercury and therefore an extrapolation was made. The percentage of sodium halide lamps sold for the year 2016 was estimated from consultations with retailers and then applied to the total number of discharge lamps imported. The resulting value of 77, 981 sodium halide lamps was entered into the inventory with the remainder of 20,132 for metal halide lamps.

Outdoor sign lamps

Outdoor sign lamps that utilize argon gas contain mercury which causes the lamps to brighten when charged with electricity (Edison Tech Centre, 2013). A local sign manufacturer was contacted and revealed that they imported 15 kg of mercury into the country five (5) years prior. The manufacturer indicated that imports are irregular as only 0.5 mL is added to each argon lamp. The glass lamps are then sealed ensuring no mercury can escape into the environment unless the lamp is broken.



Lighthouses

In lighthouses, mercury is used in the bath that houses Fresnel lenses and allows for easy rotation of the lenses. There are currently four (4) lighthouses in Trinidad and Tobago - Fort George, Galera Point, Brigand Hill and Bocas lighthouses. While the Bocas Lighthouse has been upgraded and no longer functions with mercury, the Fort George and Brigand Hill lighthouses still contain approximately 2 - 4 kg of mercury. No information was obtained for the Galera Point lighthouse.

Summary of Inputs and Results

The following table (Table 13) summarizes the mercury inputs and releases to Trinidad and Tobago from the use and disposal of light sources with mercury.

Table 13: Analysis of mercury input and output factors for various light sources in Trinidad and Tobago, 2016

Light Sources with Mercury	Use and Disposal
Activity rate (items/y):	
- Fluorescent tubes	639,867
- CFLs	1,068,108
- Sodium vapour lamps	77,981
- Mercury halide lamps	20,132
Input factor for phase (mg Hg/item):	
- Fluorescent tubes	25
- CFLs	10
- Sodium vapour lamps	20
- Mercury halide lamps	25
Calculated input to phase (kg Hg/y):	
- Fluorescent tubes	16.00
- CFLs	10.68
- Sodium vapour lamps	1.56
- Mercury halide lamps	0.50
Total input to phase (kg Hg/y)	28.74
Calculated output/releases (kg Hg/y) to:	
- Air	1.44
- Water	-
- Land	-

Light Sources with Mercury	Use and Disposal
- Products	-
- General waste treatment	27.30
- Sector specific waste treatment	-

2.5.4 Batteries with Mercury

Mercury is a very effective suppressor of zinc corrosion, which ultimately prevents the build-up of hydrogen, a potentially explosive gas, in various types of batteries. It is also used in high concentrations as a positive electrode in mercury-oxide batteries which are also called zinc-mercury batteries (UN Environment, 2017a). Batteries are among the largest product uses of mercury globally.

Prior to 1997, mercury-oxide batteries were found in motorized equipment, hearing aids, watches, calculators, computers, smoke detectors, tape recorders, regulated power supplies, scientific equipment, pagers, and portable electrocardiogram monitors. Over the years, developed countries have banned or limited the use of mercury in batteries and are now manufacturing batteries without intentionally added mercury content. However, mercury is still used in some button-cell shaped batteries of alkaline, silver oxide and zinc/air types that can be found in hearing aids, electronics, small toys and watches.

Mercury from batteries can escape into the environment after they have been disposed of in landfills. The main mercury release pathways for batteries are through the atmosphere, land and general waste (UN Environment, 2017a).

In Trinidad and Tobago, it was discovered that very few batteries containing mercury are imported into the country and the total amount for 2016 was 14 units with a total net weight of 112.82 kg based on the data from the Customs and Excise Division. The weight was converted to tonnes and entered into the inventory as the activity rate. The description of these items was “Primary Cells and Primary Batteries: Mercuric Oxide”

and China was identified as the main supplier of mercury batteries to Trinidad and Tobago.

Summary of Inputs and Results

The following table (Table 14) summarizes the mercury inputs and releases to Trinidad and Tobago from the use and disposal of batteries with mercury.

Table 14: Analysis of mercury input and output factors for batteries with mercury in Trinidad and Tobago, 2016

Batteries with Mercury	Use and Disposal
Activity rate	0.11 t/y
Input factor for phase	320 kg Hg/t
Calculate input to phase	36.16 kg Hg/y
Calculated outputs/releases to:	
- Air	-
- Water	-
- Land	-
- Products	-
- General waste treatment	36.16 kg Hg/y
- Sector specific waste treatment	-

2.5.5 Cosmetics and Related Products with Mercury

Skin lightening products

Skin bleaching involves the use of products such as creams, soaps, injections and home-made products to depigment skin. Depigmentation is a procedure by which the melanin produced in the skin is reduced, resulting in lightened skin (Mohammed et al., 2017). Inorganic mercury is an effective suppresser of melanin production and is therefore, found in skin-lightening products identified on the global market (Boischio, 2017).

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

(Hamann, et al., 2014; Copan et al., 2015). Trinidad and Tobago has seen a rise in the number of skin lightening creams being promoted in the country. This trend has been developing for the past decade as skin bleaching has become popular in beauty fads, culture and music. Further discussions on the social issues associated with skin lightening creams and the recommendations to address them are noted in Chapters 4, 5 and 6 of this report.

It was noted that some skin-lightening creams on the local market contain other melanin suppressors such as hydroquinone rather than mercury; however, more testing of the products being sold should be done to accurately determine this. While certain products list mercury as an ingredient, many are unlabelled, mislabelled, counterfeit, or labelled in a foreign language, so the risk of using any of these products is increased as consumers are not able to identify their components (Zero Mercury Working Group, 2010). Due to this issue, the identification of the number of skin lightening creams imported into Trinidad and Tobago could not be quantified for this inventory. Lewis, et al. (2011) also noted that many of these creams have been found to be sold on the black market which indicates that they would likely not be able to be accounted for by Customs officials.

Mohammed et al (2017) performed an evaluation on fifteen (15) common skin-lightening creams found throughout Trinidad and Tobago and concluded that all 15 products were “unsafe” for prolonged human use as they each contained significant amounts of mercury and arsenic - another toxic substance.

According to retailers and cosmetic counter clerks, Silken Bleaching Cream, formerly Nadinola, is a popular product among customers in Trinidad and Tobago. The product is manufactured in Jamaica and imported into the country. Among the products tested by Mohammed et al (2017), Deluxe Silken proved to have the highest mercury concentration of 14,507.741±490.75 µg/g. This product highlights the addition of mercury on the label. The number of mercury containing skin lightening products imported into Trinidad and Tobago in 2016 could not be confirmed and, as such, further research is necessary.



2.5.6 Summary of Mercury Releases from the Use and Disposal of Consumer Products (whole life-cycle)

The intentional use of mercury in the aforementioned mercury-added consumer products contributes to the release of mercury in Trinidad and Tobago. The major MAPs identified are highlighted in Figure 14. Electrical switches and relays with mercury were identified as the consumer product of most concern with regards to estimated mercury releases in Trinidad and Tobago, though it was noted that the releases from this product were determined based on default calculations rather than actual mercury content and may therefore be an over-estimation. Mercury-added skin-lightening creams were also identified as present, however, the mercury releases from this product could not be quantified at the time of the inventory.

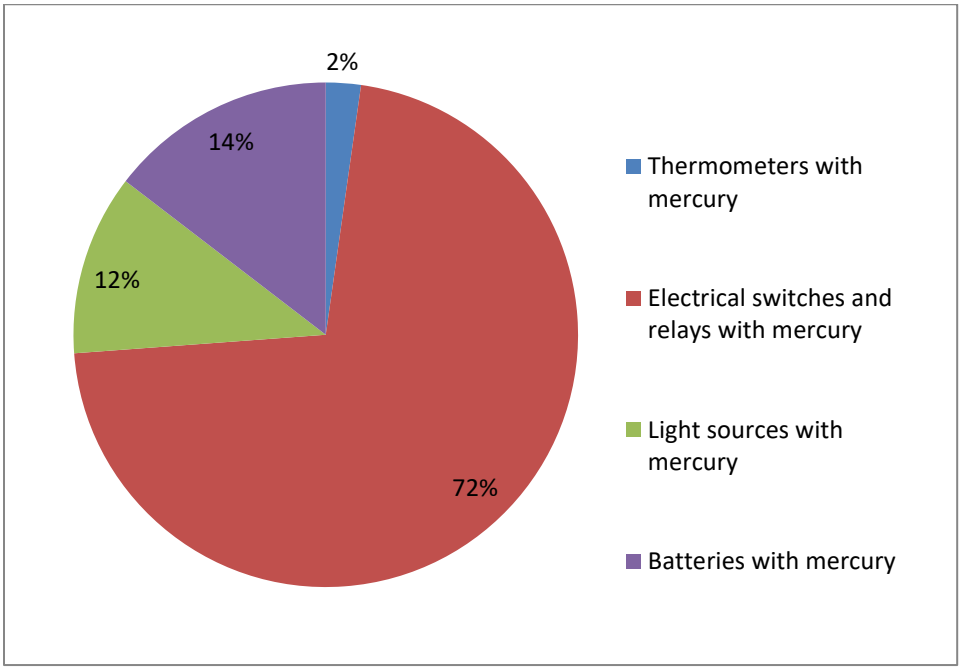


Figure 14: Summary of the mercury releases from the use and disposal of consumer products with mercury in Trinidad and Tobago for 2016.

2.6 Data and Inventory on Other Intentional Product/Process Use of Mercury

2.6.1 Dental Amalgam Fillings

Dental mercury-amalgam is used to restore teeth with dental cavities. It is a mixture of liquid mercury and a powder containing silver, tin, copper, zinc and other metals (US EPA, 2016). It can be supplied to dentists in powder form, where pure mercury and powder of other metals are to be measured out and mixed in an agitator at the dental facility; or as small capsules, in which the mercury and the powder of other metals are pre-mixed in the right formula for immediate use in the clinic.

Dental amalgam fillings have an approximate life-time of 10-20 years, and mercury can be released to air, water, products and general waste through its production, preparation in clinics, use and disposal. Mercury from placing dental amalgam fillings can be released when left-over amalgam is washed down sinks in a clinic or discarded in general waste, and when particles are expelled while making adjustments to the shape of the filling. Additionally, procedures to renew and replace dental amalgam lead to particulate releases into wastewater systems if dental chairs are not equipped with mesh filters or more efficient central filters. Low quantities of mercury are also continuously emitted from a person's mouth during use. Disposal occurs when teeth containing dental amalgam are removed, or when a person with dental amalgam fillings dies and is cremated or buried.

According to Paryag et al (2010), the different methods that dentists in Trinidad and Tobago use to dispose of the dental amalgam include disposal in general trash (48.8%), disposal down the sink (39.5%) and disposal as hazardous waste (37.2%).

Trinidad and Tobago has 425 registered dentists between the public and private sectors. They are represented by the Dental Council of Trinidad and Tobago (DCTT) which is elected by, and responsible for managing the Dental Board of Trinidad and Tobago. The Council was formed in accordance with the Dental Profession Act. The role of the Council is to ensure the registration of dentists and dental auxiliaries,

maintain the proper standards of professional conduct and to hold inquiries into allegations of improper or unprofessional conduct.

The DCTT was contacted for assistance in distributing the questionnaires to dentists via email. In addition, visits were made to dental clinics to obtain information from those willing to contribute to the project. The inventory allows for estimations to be made on dental amalgam as a mercury source based on the population and the number of dentists present in the country. It should be noted that the Dental School in Trinidad and Tobago, which is a part of the University of the West Indies, St Augustine Campus, includes the use of dental amalgam as a practical component in the clinical training curriculum and the waste is either washed down the sink or put into a container filled with a liquid-water mixture.

The total mercury input for Trinidad and Tobago from the preparation of dental amalgam was calculated based on 2016 population data. The output to the environment from this life-cycle phase was noted to be a fraction of the input as it did not account for the mercury that would be released in subsequent years through use and disposal. The output through the use of amalgam in 2016 was estimated using the mercury input from dental amalgam consumed nine (9) years prior, in 2007. These releases were assumed to occur from damaged fillings that were replaced or repaired in 2016, and from direct releases from the user's mouth during 2016. Mercury releases from the disposal of "spent" dental amalgam were determined from population data for 1997 since the expected end-of-life of dental amalgam is approximately 20 years after consumption. Releases from cremation and burial of people with dental amalgam were also taken into consideration in the disposal life-cycle phase of dental amalgam. Population data for 2016, 2007 and 1997 were retrieved from the World Bank.

The input factor for each life-cycle phase was calculated as the number of dentists in the country for every 1,000 inhabitants in each of the relevant years. For the preparation phase, this value was calculated using the determined 425 registered dentists for a population of 1,364,962 in 2016. Estimations based on 2007 WHO statistics were used for the use phase. For disposal, the input factor was obtained from the Technical Annexes of the UN Environment's Toolkit Reference Report (2017).



Summary of Inputs and Results

The following table (Table 15) summarizes the mercury inputs and releases to Trinidad and Tobago from the preparation, use and disposal of dental amalgam.

Table 15: Analysis of mercury input and output factors for dental mercury amalgam fillings in Trinidad and Tobago, 2016

Dental Mercury Amalgam Fillings	Unit	Preparation of Fillings at Dental Clinics	Use	Disposal	Sum of Releases to Pathway from Assessed Part of Life-Cycle
Activity rate	inhabitants	1,364,962 (2016)	1,309,260 (2007)	1,260,678 (1997)	-
Input factor for phase	g Hg/(y*inh.)	0.314	0.199	0.084	-
	Dentists/1000 inh	0.2	0.199	0.084	
Calculated input to phase	kg Hg/y	103.34	62.83	25.54	-
Output distribution factors for phase:					
- Air	N/A	0.2	-	-	-
- Water	N/A	0.14	0.02	0.3	-
- 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	2.05	-	-	2.05
- Water	kg Hg/y	14.35	1.26	7.67	23.28
- Land	kg Hg/y	-	-	2.04	2.04
- Products	kg Hg/y	-	-	1.53	1.53
- General waste treatment	kg Hg/y	12.30	-	2.04	14.34
- Sector specific waste treatment	kg Hg/y	12.30	-	2.04 kg	14.34

2.6.2 Manometers and Gauges

Mercury is used in some blood pressure gauges, pressure valves, and industrial and meteorological manometers. Mercury was popularly used due to its high density and its effectiveness in responding to various pressure changes. The majority of mercury-containing devices are sphygmomanometers or blood pressure gauges. Non-mercury alternatives exist for all uses and are gradually being substituted for the mercury-using equivalents in some countries; though it was noted that there is some reluctance to promote mercury-free alternatives due to the belief that the mercury devices are more accurate (Palmer, 2016). The mercury may be disposed of with the apparatus or separately.

2016 import data obtained from the Customs and Excise Division was used to estimate the mercury releases from these products. The Customs datasheet grouped manometers and gauges under labels for “other instruments” such as hygrometers, psychometers and barometers. It also did not differentiate between mercury-added and mercury-free instruments. For the purpose of the inventory, it was assumed that all instruments listed under the above-mentioned labels were mercury-added manometers and gauges.

Summary of Inputs and Results

The following table (Table 16) summarizes the mercury inputs and releases to Trinidad and Tobago from the use and disposal of manometers and gauges with mercury.

Table 16: Analysis of mercury input and output factors for manometers and gauges in Trinidad and Tobago, 2016

Manometers and Gauges	Use and Disposal
Activity rate	1804 items/year
Input factor for phase	80 g Hg/item
Calculated input to phase	144.32 kg Hg/y
Calculated outputs/releases to:	
- Air	14.43 kg Hg/y
- Water	43.30 kg Hg/y
- Land	-
- Products	-
- General waste treatment	86.59 kg Hg/y
- Sector specific waste treatment	-

2.7 Data and Inventory on Waste Incineration

Waste incineration in Trinidad and Tobago refers to the burning of municipal, medical and hazardous waste in dedicated incinerators. Informal open burning also occurs at landfills and in many residential backyards. Trinidad and Tobago has a history of open fires occurring in the Beetham Landfill, the largest landfill in the country. The causes of these fires are often suspected to be scavengers who reside in the landfills.

2.7.1 Incineration of Municipal Waste

The mercury content in the general waste stream originates from three main groups of inputs:

1) intentionally used mercury in discarded products and process waste;

2) natural mercury impurities in high volume materials (plastics, paper, etc.) and minerals; and

3) mercury as a human-generated trace pollutant in high volume materials.

Refuse or municipal solid waste (MSW) consists primarily of household garbage and other non-hazardous commercial, institutional, and non-manufacturing industrial solid waste (UNEP 2015b). Known sources of mercury in MSW include, but are not limited to, batteries, discarded electrical equipment and wiring, fluorescent lamps, teeth and other dental amalgam waste, paint residues, and plastics.

Companies exist in Trinidad and Tobago which can be hired to perform incineration of municipal waste and non-hazardous waste which may contain mercury. In general, households would not employ these waste incineration companies to dispose of their own waste. Out of the three (3) main companies in Trinidad and Tobago that collect waste for incineration, only one (1) replied to stakeholder questionnaires sent during the inventory and they stated that they incinerated approximately 163 tonnes of municipal

solid waste a year. This figure was extrapolated to represent the 3 main companies assuming that similar volumes of waste are collected by each company.

2.7.2 Incineration of Hazardous Waste

Hazardous waste refers to residues and wastes which contain hazardous materials in significant quantities including materials which require special precautions and restrictions during handling. These include solvents and other volatile hydrocarbons, paints and dyes, chemicals including pesticides and herbicides, pharmaceutical products, batteries, fuels, oils and other lubricants, as well as goods containing heavy metals. Materials which are contaminated with these materials such as soaked rags, paper, treated wood and production residues are also considered hazardous waste (UNEP, 2003).

Information for this inventory sub-category was gathered from questionnaires sent to private waste incineration companies (hired by other companies to dispose of their hazardous waste) and regional health authorities. Only 1 response to the questionnaires sent was received from the Tobago Regional Health Authority indicated that an average of 22.7 tonnes of hazardous waste was incinerated per year (not including medical waste). This was entered into the inventory as the activity rate but shows a clear underestimation as it does not include hazardous waste incineration in Trinidad or the consideration of hazardous waste generated from households. Due to the lack of information about the types of hazardous waste incineration operations at other incineration facilities, an extrapolation for entry into the Toolkit was note made. It is very rare that citizens would hire a waste disposal company to deal with their personal waste.

2.7.3 Incineration of Medical Waste

Medical waste includes infectious and non-infectious wastes generated by facilities such as hospitals, nursing homes, doctors' and dentists' offices engaged in medical care, veterinary care, or research activities. The waste generated during these activities

includes secretes, blood, pharmaceuticals and packaging materials and/or tools used for the medical treatment of people or animals. To ensure the destruction of viruses, bacteria, and pathogens, this waste is often treated by incineration. Available information indicates that medical waste incinerator systems can be significant sources of mercury emissions. Mercury emissions result from mercury-bearing materials contained in the waste such as thermometers, dental material with mercury amalgam, blood pressure gauges, batteries, laboratory chemicals (in tissue samples etc.), fluorescent lamps and high-intensity discharge lamps (mercury vapour, metal halide, and high-pressure sodium). These items should be separated from the waste stream before incineration.

In Trinidad and Tobago, medical waste incinerators are present in three of the main hospitals. These include Port of Spain General Hospital, San Fernando General Hospital and Scarborough General Hospital. Medical waste incinerators can also be found at private companies. Two of the hospitals and one of the private companies provided responses to the questionnaires resulting in a total of 218.19 tonnes of waste incinerated per year.

2.7.4 Informal Waste Burning

Informal waste burning is defined as waste incineration undertaken in informal conditions such as in barrels, containers, or on bare land without flue gas controls and the diffuse spreading of incineration residues on land (UNEP, 2015a). If mercury is present in the waste, part of it will be released to air, while the remainder in the incineration residues (including unburned and semi-degraded waste) have potential for additional releases to air, land, ground-water and surface waters. This waste disposal method may pose an immediate risk for the local community in which it takes place, because air emissions that may contain mercury and several other potent pollutants which are not controlled and the residues may cause contamination of the local ground-water.

In Trinidad and Tobago, it is common to see residents burning garbage on their property. The frequency of this activity and the amount of garbage burnt is difficult to quantify. As a result, the inventory only highlights the informal burning that occurs in landfills.

According to the questionnaire responses from the Trinidad and Tobago Solid Waste Management Company (SWMCOL), the estimated amount of waste burned informally in three of the landfills in Trinidad was 85,400.7 tonnes for 2016. This value was not based on recorded figures, but rather on a rough estimate of the volume of waste burnt which was converted to weight using a density factor of 750 pounds per cubic yard (Mississippi Department of Environmental Quality) Informal waste burning data for Studley Park Integrated Facility in Tobago was not required as it is a more controlled landfill and informal burning is not common.

Summary of Inputs and Results for Waste Incineration

The following table (Table 17) summarizes the mercury inputs and releases to Trinidad and Tobago from all of the waste incineration sub-categories found to be present.

Table 17: Analysis of mercury input and output factors for waste incineration in Trinidad and Tobago, 2016

Incineration	Units	Municipal Waste	Hazardous Waste	Medical Waste	Informal Waste Burning
Activity rate	t/y	489.60	22.73	218.19	85,400.7
Input factor for phase	g Hg/t	5	24	24	5
Calculated input to phase	kg Hg/y	2.45	0.55	5.24	427.00
Output distribution factors for phase:					
- Air	N/A	0.9	0.9	0.9	1
- Water	-	-	-	-	-
- Land	-	-	-	-	-
- Products	-	-	-	-	-
- General waste treatment	-	-	-	-	-
- Sector specific waste treatment	N/A	0.1	0.1	0.1	-
Calculated outputs/releases to:					
- Air	kg Hg/y	2.21	0.50	4.72	427.00

Incineration	Units	Municipal Waste	Hazardous Waste	Medical Waste	Informal Waste Burning
- Water	-	-	-	-	-
- Land	-	-	-	-	-
- Products	-	-	-	-	-
- General waste treatment	-	-	-	-	-
- Sector specific waste treatment	kg Hg/y	0.25	0.06	0.52	-

2.8 Data and Inventory on Waste Deposition, Landfilling and Wastewater Treatment

The final disposal and management of certain waste products can result in the release of mercury emissions and releases in a country.

2.8.1 Controlled Landfills/Deposits

Trinidad and Tobago utilizes landfilling methods to dispose of solid waste. The country's municipal waste is managed by municipal corporations who arrange for collection and transport of the waste to the landfills. Landfilling releases relatively small amounts of mercury annually to the atmosphere (as portions of the mercury slowly evaporates from the waste) and to water (leachate water and surface run-off). The fate of the mercury released to water depends greatly on the presence of a protective lining under the deposit and associated wastewater management. If the water is not collected and sent for wastewater treatment, the mercury can contaminate soil and groundwater under and around the landfill. If the water is sent to wastewater treatment, the mercury will mainly follow the sludge portion of the treated material and go to land use or another fate, while the rest will follow the water discharge from the wastewater treatment (COWI, 2002).

There are three (3) major landfills managed by SWMCOL in Trinidad located at Beetham in Port-of-Spain; Guanapo in Arima; and Forres Park in Claxton Bay. The Studley Park Integrated Facility in Tobago is managed by the Tobago House of Assembly. A map showing the locations of these landfills is presented in Figure 15. There is also an additional disposal site, Guapo, which is managed by the Point Fortin Borough Corporation, in addition to informal dumps throughout the country.

Beetham Landfill: Port-of-Spain, Trinidad

The Beetham landfill is the largest in the country and houses close to 65 percent of the waste generated. The landfill was started in a mangrove swamp with shallow ground water and now covers 61 hectares of land. Located on the outskirts of the capital, Port of Spain (7 km away), the landfill is a hazard to the nearby Beetham Gardens community. It has been scheduled for closure, but finding an appropriate location for a

new landfill has been an issue. According to SWMCOL, the landfill accepts almost 1,000 tonnes of garbage per day.

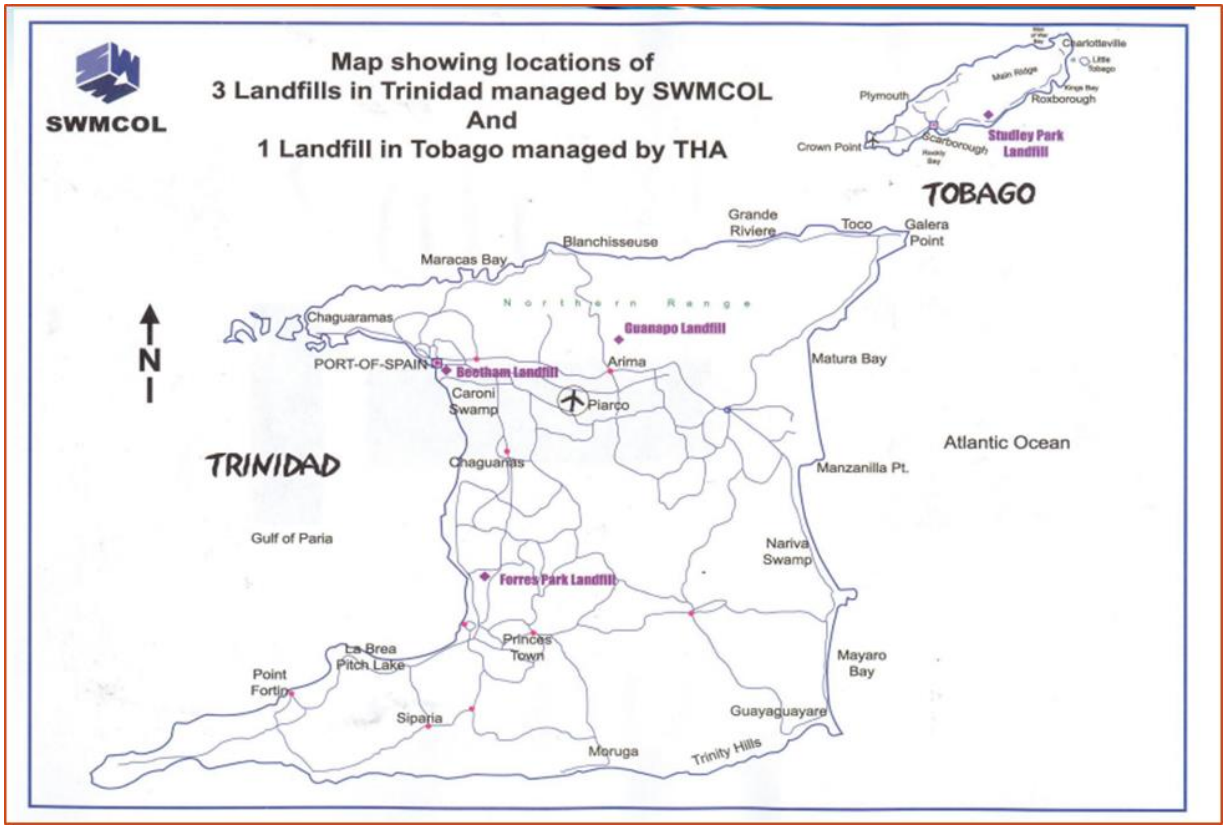


Figure 15: Location of landfills in Trinidad and Tobago
(Source: SWMCOL, 2011)

Guanapo Landfill: Arima, Trinidad

Guanapo landfill is the smallest of the SWMCOL-managed landfills in Trinidad. It is located in eastern Trinidad, neighbouring the Guanapo River. This poses as a serious health risk as the water in the river could easily become contaminated. This was assessed in a prior study conducted by Beckles et al (2016), *"The Impact of the Contaminants Produced by the Guanapo Landfill on the Surrounding Environment Final Report"* which is discussed further in this report in Section 2.12.

Forres Park Landfill: Claxton Bay, Trinidad

Forres Park is the second largest landfill in the country. It contains a leachate collection system and groundwater monitoring wells as part of its infrastructure (GoRTT, 2015). This landfill is located in central Trinidad. There are discussions for the development of an engineered landfill at Forres Park.

Studley Park Integrated Facility: Mason Hall, Tobago

The Studley Park Integrated Facility is operated by the Tobago House of Assembly (THA) and is the only official disposal site for Tobago. It is located 15 km east of Scarborough. The site was developed and commissioned by SWMCOL in the mid 1980's and brought under the purview of the THA in 1989. The site is comprised of a sanitary landfill, an oily waste collection facility and a faecal waste disposal system. The landfill has an expected capacity to accept a solid waste inflow of 7,360 tonnes per year throughout its lifespan. According to the THA, the waste entering the landfill is primarily paper and plastic.

According to SWMCOL, an estimation of the total amount of waste landfilled in their facilities in Trinidad and Tobago in 2016 is 750,000 tonnes. This data was entered into the inventory as the activity rate. The waste managed in the Guapo disposal site and in informal dumping sites throughout the country should be determined and included in future assessments.

Summary of Inputs and Results

The following table (Table 18) summarizes the mercury inputs and releases to Trinidad and Tobago from waste deposition/landfilling.

Table 18: Analysis of mercury input and output factors for waste deposition in Trinidad and Tobago, 2016

Waste Deposition	Waste Landfills
Activity rate	750,000 t/y
Input factor for phase	5 g Hg/t
Calculated input to phase	3750 kg Hg/y

Waste Deposition	Waste Landfills
Calculated outputs/releases to:	
- Air	37.50 kg Hg/y
- Water	0.38 kg Hg/y
- Land	-
- Products	-
- General waste treatment	-
- Sector specific waste treatment	-

2.8.2 Informal Dumping of General Waste

This relates to disposal of general waste in the absence of safeguards preventing the release of pollutants into the environment (UNEP, 2017a). Residential, green and construction waste represent the major waste types dumped. Though illegal, informal dumping has been noted to occur in Trinidad and Tobago. The amount of general waste informally dumped was unable to be quantified at the time of the inventory and it is unknown whether this practice presents a potential mercury danger to groundwater or the local community.

2.8.3 Waste-water System and Treatment

Mercury in waste water originates from the two main source groups:

1. Intentionally used mercury in products and processes such as dental amalgams, broken thermometers and other devices, and industrial discharges; and
2. Atmospheric mercury, originating from both natural and anthropogenic sources that is washed out by precipitation which makes its way into soil, surface and ground water.

Waste water systems are an intermediate mercury release pathway, where the mercury will either be released into the waterways after the treatment of waste water, or distributed through sludge as fertiliser on land or as waste deposited at a landfill (UNEP, 2017a).

Wastewater treatment processes can include different stages - primary (involves mechanical filtration of debris, sand and sludge); secondary (involves clarification and disinfection through processes involving chlorine or ultraviolet light) and; tertiary (involving nutrient removal).

According to the Wastewater Effluent Discharge Assessment done in October 2017 by the Water and Sewage Authority (WASA) of Trinidad and Tobago, the primary socio-economic concerns that affect effluent discharges in Trinidad and Tobago are port-maritime operations, oil refineries, iron and steel industries, fertilizers, industrial gases, food processing plants, breweries, animal feedstuffs, cosmetics, paper and manufacturing industry, schools, urban and farming settlements and the medical industry. Wastewater discharge from these point sources all enter into various treatment facilities and are treated to ensure that all the parameters are within those guided by the Water Pollution Rules. Presently, there are 37 wastewater treatment facilities that fall under the management of WASA. The total yearly average flow rate of 41,227,845 m^3/y for 2011 was obtained and a 10% increase was applied to represent 2016 due to the developments done in these areas. The adjusted value was entered into the inventory.

Summary of Inputs and Results

The following table (Table 19) summarizes the mercury inputs and releases to Trinidad and Tobago from wastewater treatment.

Table 19: Analysis of mercury input and output factors for wastewater treatment in Trinidad and Tobago, 2016

	Wastewater Treatment
Activity rate	45,350,629.50 m^3/y
Input factor for phase	5.25 mg Hg/m^3
Calculated input to phase	238.09 kg Hg/y
Calculated outputs/releases to:	
- Air	-
- Water	119.05 kg Hg/y
- Land	-
- Products	-
- General waste treatment	71.43 kg Hg/y
- Sector specific waste treatment	47.62 kg Hg/y

2.9 Data and Inventory on Crematoria and Cemeteries

Mercury may be released from crematoria and cemeteries due to the presence of dental amalgam fillings in the corpses' teeth and a small percentage from mercury accumulation in the body tissue through fish consumption and other exposure pathways. The mercury is released to land during decay in cemeteries or to air in the cremation process (UNEP, 2017a).

2.9.1 Crematoria

Cremation, the incineration of human corpses, is a common practice in many countries and is becoming significantly more popular due to the lower cost as compared to burial in cemeteries. In Trinidad and Tobago, crematoria furnaces are fired using electricity.

In addition to furnaces, open pyre burning occurs among the Hindu population of Trinidad and Tobago. The ritual is primarily religious and involves laying the corpse in a pyre and setting on fire.

Data for cremations were obtained through questionnaires sent to funeral homes. The response rate was 16%. The information provided was used along with data of deaths provided by the Central Statistics Office. A value of 11,590 corpses cremated was entered as the activity rate.

2.9.2 Cemeteries

In Trinidad and Tobago, cemeteries are typically located inland in villages and cities. The information received from questionnaires given to funeral homes and from the Central Statistics Office provided a value of 10,690 burials used as the activity rate.

Summary of Inputs and Results for Crematoria and Cemeteries

The following table (Table 20) summarizes the mercury inputs and releases to Trinidad and Tobago from cremations and burials.

Table 20: Analysis of mercury input and output factors for cremations and cemeteries in Trinidad and Tobago, 2016

Crematoria and Cemeteries	Unit	Crematoria	Cemeteries
Activity rate	corpses cremated/y	11,590	-
	corpses buried/y	-	10,690
Input factor for phase	g Hg/corpse	2.5	2.5
Calculated input to phase	kg Hg/y	28.98	26.73
Output distribution factors for phase:			
- Air	N/A	1	-
- Water	-	-	-
- Land	N/A	-	1
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-
Calculated outputs/releases to:			
- Air	Kg Hg/y	28.98	-
- Water	-	-	-
- Land	Kg Hg/y	-	26.73
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-

2.10 Stock of Mercury and/or Mercury Compounds, and Storage Conditions

According to Article 3 of the Minamata Convention, each Party shall endeavour to identify individual stocks of mercury or mercury compounds over 50 metric tonnes, as well as sources of mercury supply generating stocks exceeding 10 metric tons per year, that are located within its territory.

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.

Based on the inventory it was determined that stocks of the above mentioned quantities are not present in Trinidad and Tobago.

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

Under Article 3 of the Minamata Convention, “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.

Based on the inventory, it was determined that no significant sources of, nor recycling activities of, mercury and mercury compounds are present in Trinidad and Tobago.

2.12 Impacts of Mercury on Human Health and the Environment

Mercury is noted to be toxic to humans and the environment when it forms the organic compound, methylmercury. The process of methylation, whereby mercury is converted to methylmercury, varies widely across various landscapes and within waterscapes. Areas that are particularly sensitive to mercury deposition generally represent aquatic ecosystems or have an aquatic connection within the food web. Methylmercury tends to biomagnify in food webs and bioaccumulate over time in organisms which are then consumed by humans. Fish from the sea or freshwater systems can be a major source of methylmercury, and it has been determined that generally, predatory species that are long-lived and grow larger can contain higher levels of methylmercury, though it may vary from species to species (BRI, 2018).

Prior research was conducted by individuals in Trinidad and Tobago to investigate the effects of mercury contamination in the environment and the impact on the human population. Pereira and Teelucksingh (2009) analyzed the blood samples of two middle aged men who complained of back aches and weakness. These men admitted that they were avid consumers of fish (mainly canned tuna and locally-sourced shark). The cause of their ailments was attributed to high levels of mercury found in their blood streams which was linked to their high consumption of fish with assumed high mercury levels.

In addition, Mohammed et al (2011) reported elevated levels of mercury in fish sampled from the Caroni Lagoon. Mercury values ranged between 0.33 and 0.60 mg/kg which is above the International Atomic Energy Agency tolerable value of 0.22 mg/kg for metals in fish. Mohammed and Mohammed (2017) found that mercury levels in different species of shark ranged between 74–1899 µg/kg in *S. lewini* and 67–3268 µg/kg in *C. porosus*. Fish with values of mercury greater than 950 µg/kg are not recommended for consumption by WHO.

Beckles et al (2016) assessed the impact of contaminants produced by the Guanapo landfill site on the surrounding environment. Soil and water were tested in several surrounding sites and most were found to contain mercury. Mean mercury levels in surface water were found to be highest (2.65 µg/L) in the Guanapo landfill's leachate

pond and the highest mean mercury concentrations for sediment (0.09 mg/kg) were found in the leachate stream samples. Mercury levels were most likely due to the landfill leachates as MAPs are often disposed of as municipal waste in landfills.

Mohammed, T., Mohammed, E. and Bascombe, S. (2017) evaluated the concentrations of mercury in skin-lightening products commonly found and used in Trinidad and Tobago as well as the potential risks to human health. The different brands found in various pharmacies and retailers throughout the country were tested and analyzed in a laboratory for mercury and arsenic concentrations. All fifteen (15) samples were deemed “unsafe” for prolonged human use due to elevated concentrations of mercury.

Chapter 3: Policy, Regulatory and Institutional Framework Assessment

An assessment of the policy, regulatory and institutional framework was conducted by legal consultant, Dr. Winston McCalla. The following has been extracted from Dr. McCalla's report, "Assessment of the Legislative and Institutional Framework in Relation to the Implementation of the Minamata Convention on Mercury in Jamaica, Saint Kitts and Nevis, Saint Lucia and Trinidad and Tobago", 2018.

3.1 Assessment of Policies

3.1.1 Existing Policies

This section deals with the policies that are related or potentially related to mercury and the explanations of what provisions are being addressed or can be addressed to facilitate the implementation of the Minamata Convention.

The Environmental Management Authority (EMA) has been instrumental in the development of many of these policies, including the National Environmental Policy. The former Ministry of the Environment and Water Resources was also instrumental in the development of the National Waste Recycling Policy.

National Environmental Policy, 2006

As stipulated in the Environmental Management (EM) Act, the National Environmental Policy (NEP) was prepared by the Board of Directors of the Environmental Management Authority (EMA). The current version is the second NEP after the 1997 draft (approved in 1998). The NEP is considered as the national "umbrella" environmental policy and it recognizes "that humans influence and are influenced by their environment" and states that the "Government therefore accepts the responsibility to adopt policies and measures with a view to improving human health and the quality of life". The policy recognizes that the "economically challenged… have a direct dependence on

ecosystem services in order to be adequately nourished and have access to clean air and water" and that "environmental factors (water contamination, air pollution, hazardous waste, climate change) are a root cause of death, diseases and disability."

The goal of the NEP is "environmentally sustainable development" meaning the balance of economic growth with environmentally sound practices in order to enhance the quality of life and meet the needs of present and future generations. The specific objectives are to:

- Prevent, reduce or where possible recycle all forms of pollution to ensure adequate protection of the environment and consequently the health and well-being of humans;
- Conserve the vitality and diversity of the natural environment through the conservation of ecological systems and the biodiversity within;
- Develop within the carrying capacity (the assimilative capacity of the environment) of the country through national physical development and planning; and the sustainable use of renewable resources and the conservation of non-renewable resources;
- Change attitudes and practices of citizens with a view to reducing the polluting practices of the public;
- Ensure that all industries install a certified Environmental Management System;
- Empower stakeholders, including communities, to care for their own environments by providing opportunities to share in managing their local resources and the right to participate in decision-making; and
- Promote the integration of the principles of environmental sustainable development into all national policies and programmes.

The basic principles of the NEP are:

- Respect and care for the community of life;
- Keep within the country's carrying capacity;
- Empower communities to care for their own environments;
- Polluter pays principle; and



- Precautionary principle.

The NEP provides for the protection of water resources and states that the Government will "prevent the degradation of water quality which shall cause the water quality in any area to fall below that necessary to protect the uses of the water for the propagation of aquatic life and for recreation in and on the water and to protect human health including preventing any activity which may include discharging or depositing a pollutant into any waters which may cause any of the following; …

(vi) the water to become toxic to vegetation on land; or

(vii) the water to become harmful or offensive to humans, livestock or native animals."

The NEP also aims to (among other objectives):

- Establish ambient water quality guidelines consistent with use as well as standards and limits on the concentration of substances in point source discharges; and

- Prohibit the direct or indirect discharges of hazardous substances to surface water and ground water aquifers.

Chapter 4 of the NEP deals with pollution, hazardous and toxic substances and states that the Government "will operate an integrated environmental management system, which will cover all major solid, liquid and gaseous emissions to air, land and water." While there is a sub-section dealing specifically with air pollution, mercury and/or mercury compounds are not specifically identified as one of the pollutants, but the Government will, "(d) Develop a list of air pollutants to be controlled above maximum permissible levels" to which mercury and its compounds can be added. With this language in place, the Government will be required to, "Protect public health from the adverse effects of air pollution using the national ambient air quality standards and eliminate, or reduce to a minimum, those air pollutants that are known to be or are likely to be hazardous to human health and the environment". There are no sub-sections that refer specifically to water or land pollution, however, sub-sections 4.7, 4.8 and 4.9 deal

with wastes, hazardous substances and spills, and contaminated land, respectively, with each having provisions for managing pollution to water and land. For example, sub-section 4.7 on Wastes states that provisions should be made to ensure that, “waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment and, in particular, without risk to air, water, soil, and plants and animals”.

Section 4.7.1 of the NEP deals with hazardous waste and requires the Government, through the EMA, to create “a list of hazardous wastes, establish requirements for their handling and disposal, establish standards and design criteria for hazardous waste handling and disposal facilities, and enforce these requirements through licensing and permitting requirements.” The section goes on to refer specifically to the Basel and Stockholm Conventions. If the Government chooses to accede, the Minamata Convention could also be added in a future version of the NEP.

As of December 2017, the NEP was being updated by the Government through the EMA, however it does not include the Minamata Convention (as Trinidad and Tobago is not yet a signatory) and only mentions mercury once under air pollution. Mercury and its compounds could be added to the section dealing with hazardous waste and to the relevant standards or guidelines.

National Waste Recycling Policy, 2015

The National Waste Recycling Policy was developed with the aim of removing recyclable/reusable materials from the waste stream before they reach landfills. This policy was created in response to the rapid increases in volumes of waste, particularly non-biodegradable waste, being generated. Waste disposal in Trinidad and Tobago generally consists of landfilling, and the presence of non-biodegradable waste accumulation would result in the landfill reaching capacity in a shorter period of time.

The purpose of the policy is to provide guidance for the Government of Trinidad and Tobago to enable the establishment of “an appropriate legislative, administrative and institutional framework for waste reduction and recycling”. The policy will be monitored, reviewed and updated every decade.

The policy objectives are:

- Protection of human health and the environment;
- Maximization of resource use efficiency and value recovery from waste;
- Reduction by 60% of the quantity of waste requiring final disposal by the year 2020, based on a 2010 baseline;
- Minimization of litter;
- Creation of a culture of waste minimization;
- Enhancement of economic development by the creation of novel business opportunities in the reduction, collection, handling and recycling of waste; and
- Creation of a culture of shared responsibility for waste management among government, producers, distributors and consumers.

The environmentally sound management of waste streams can also include the separation of mercury wastes entering the landfills.

Green Government Policy, 2011

The Green Government Policy was developed under the former Ministry of Housing and the Environment to ensure that the Ministries and State Board Agencies of Trinidad and Tobago go green by:

- emphasizing the need for conserving domestic resources;
- reducing pollution locally;
- minimizing the adverse effects of the Government of Trinidad and Tobago's operations on the environment.

Green procurement (outsourced goods and services meeting a certain mandatory minimum standard of greenness) is encouraged and it is hoped that this will eventually spread to the private sector. The Environmental Policy and Planning Division (EPPD) of the Ministry of Planning and Development has led initiatives aimed at integrating some of the Policy's elements into the Government's regular operations.

Under this Policy, the encouragement of green procurement can include the promotion of mercury-free alternative products such as Light Emitting Diodes (LEDs).

The Integrated Solid Waste/Resource Management Policy, 2012

The Integrated Solid Waste/Resource Management Policy establishes the plan for managing the country's waste. One of the main objectives of the policy is to manage waste through an integrated waste management system in accordance with a hierarchy that minimizes land-filling, and with an increased focus on reducing the toxicity and volume of waste through reuse, recycling, and source-separated organic waste management. The policy also advocates the following measures:

- the treatment of waste as a resource;
- emphasis on waste reduction and recycling in order to promote resource conservation and environmental protection;
- generators taking responsibility for the waste they produce;
- greater involvement of the private sector in waste management; and
- the reinvigoration of recycling.

The environmentally sound management of waste will also be considered to include the environmentally sound management of hazardous waste streams such as mercury wastes.

3.2 Assessment of Legislation

This section reviews the legislation related to mercury or potentially related to mercury.

3.2.1 Existing Legislation

Environmental Management Act, 2000 (Chapter 35:05)

The Environmental Management Act, 2000 (EM Act) established a comprehensive framework for environmental management in Trinidad and Tobago. Under the EM Act, the Environmental Management Authority is the entity responsible for managing and coordinating matters related to the environment. One of the aims of the EM Act is to establish an effective regulatory regime which will protect, enhance and conserve the environment. The EM Act is divided into nine parts (Table 21).

Table 21: The arrangement of sections in the Environmental Management Act, 2000

Sections of the EM Act	Components
Part I	The preliminary matters and interpretation of the terminology expressed in the act.
Part II	Extensive provisions for the establishment and organization of the Environmental Management Authority (EMA).
Part III	Functions and Powers of the Authority. These include, the general functions of the EMA (Section 16) the EMA's role in compiling information about the environment (Section 17), the development of a National Environmental Policy (Section 18), the development of an Environmental Code (Section 19), general powers of the EMA (Section 20), the appointment of inspectors (Section 21), powers of entry and inspection (Section 22) detaining information and samples (Section 23), the use of force (Section 24) and environmental response activities (Section 25).
Part IV	The Rules relating to public participation.
Part V	The broad framework for environmental management which is broken down into eight key areas: General (e.g. compliance with the National Environmental Policy (Section 31)), Assessment of Environmental Impacts (e.g. certificate of environmental clearance (Section 35)), Protection of natural resources (e.g. designation of environmental sensitive areas and species (Section 41)), Pollution and hazardous substances (e.g. recordkeeping and monitoring requirements

Sections of the EM Act	Components
	(Section 47)), Air and noise pollution, Water pollution, Wastes and Hazardous substances and spills.
Part VI	The mechanisms for compliance and enforcement.
Part VII	The establishment of the Environmental Trust Fund and Finances.
Part VIII	The establishment of a Tribunal to be referred to as the Environmental Commission. The Commission's jurisdiction is clearly stated in Section 81(5).
Part IX	A range of provisions including the power to make regulation set out in Section 96 and other matters.

Some of the key areas where statutory authority is vested in the Environmental Management Authority include:

- Planning and control of economic activities (Section 35-40);
- Air and noise pollution (Sections 49-51);
- Environmentally sensitive areas (Section 41);
- Environmentally sensitive species (Section 41);
- Recordkeeping and monitoring (Section 47);
- Water pollution (Section 52-54);
- Waste (Sections 55-58); and
- Hazardous substances (Sections 59-60).

The provisions of Sections 35 (certificate of environmental clearance), 49-51 (air pollution), 52-54 (water pollution) and 55-58 (waste) are relevant to the implementation of the Minamata Convention as shown in Table 22.

Table 22: The Minamata Convention and relevant Sections of the Environmental Management Act

Minamata Convention	Environmental Management Act
Article 8 – Emissions	Sections 35, 49 – 51 of Environmental Management Act and Air Pollution Rules
Article 9 – Releases	Sections 35, 55 – 58 of Environmental Management Act and Water Pollution Rules
Article 11- Mercury Wastes	Section 35, 55 – 58 of Environmental Management Act (Draft Waste Management Rules when implemented would be applicable)

Certificate of Environmental Clearance Rules, 2001[11]

Under Section 35(2) of the Environmental Management (EM) Act "no person shall proceed with any activity which the Minister has designated as requiring a Certificate of Environmental Clearance unless such person applies for and receives a Certificate from the Authority."

The Certificate of Environmental Clearance (CEC) Rules, 2001 (made pursuant to the Environmental Management Act) makes provision for the assessment of "designated activities" which may have both positive and negative environmental effects. Rule 2 defines "designated activity" as meaning an activity listed in the Schedule to the Environmental Clearance (Designated Activities) Order, 2001. Rule 2 defines "effects" as including direct and indirect, secondary, cumulative, medium and long-term, permanent, temporary, positive, negative or synergistic effects.

Under the Certificate of Environmental Clearance Rules, a requirement may be imposed for conducting monitoring and testing of mercury emissions and providing for the safe disposal of mercury and wastes containing mercury. A Certificate of Environmental Clearance would address the interim storage of mercury and mercury compounds or mercury wastes in an environmentally sound manner.

Under the CEC Rules, a certificate can be issued to an applicant to certify the environmental acceptability of a proposed activity provided that the conditions set out in

[11] Certificate of Environmental Clearance Rules, 2001. Available at: http://www.ema.co.tt/new/images/pdf/certiticate_of_environmental_clearance_rules.pdf

the Certificate of Environmental Clearance are met. The CEC Rules seek to ensure that proposed activities are assessed to consider likely impacts, environmental risks as well as mitigation and monitoring for adverse effects. However, the CEC Rules would not be applicable if there was no ongoing activity. For example, where a site has been abandoned then the CEC Rules would not be applicable. In such circumstances the provisions of Section 70 of the EM Act would have to be invoked. Under Section 70(1) any person who through the release or handling of any pollutant or hazardous substances, or through any contract or other agreement to release any pollutant or hazardous substance, knowingly or recklessly endangers human life or health, commits an offence.

Water Pollution Rules, 2001 (as amended)[12]

Section 52 of the EM Act 2000 deals with the management of water pollution in Trinidad and Tobago. Specifically, Section 52 provides as follows:

1. The Authority shall, as soon as practicable after the commencement of this Act, investigate the environment generally, and such premises and vehicles as it thinks necessary for the purposes of:

    a) ascertaining the extent of water pollution and significant sources of water pollutants; and

    b) characterising or describing that pollution.

2. The Authority shall cause a register of water pollutants to be maintained as prescribed by the Rule, which shall contain data identifying the quantity, conditions or concentrations relevant to the identification of each pollutant.

3. The Authority shall develop and implement a programme for the management of such pollution which shall include the registration and further characterisation of significant sources of any ongoing or intermittent releases of water pollutants into the environment.

Also, Section 53 of the EM Act provides:

[12] Water Pollution Rules. Available at: http://www.ema.co.tt/new/index.php/legal/legislation/water-pollution

1. The Authority may require and grant permits to authorise any process releasing water pollutants subject to such terms and conditions as it thinks fit.

2. The terms and conditions of a permit may relate to the design, construction, operation, maintenance and monitoring of the facilities, and processes releasing water pollutants.

3. A person shall apply to the Authority for the grant of a water pollution permit in accordance with the form as determined by the authority.

Section 54 of the EM Act provides that no person shall release or cause to be released any water pollutant into the environment which is in violation of any applicable standards, conditions or permit requirements under this Act.

Under the Water Pollution Rules, a person who intends to release from a registrable facility a water pollutant that is likely to cause harm to human health or to the environment, is required to submit a source application to the EMA forty-five (45) days prior to such release. However, a person who is already in the process of discharging a water pollutant from a registrable facility when the Rules comes into operation is required to submit a source application no later than 45 working days from the commencement of those rules. By Rule 4(5), unless authorised, no person shall allow the release of a water pollutant from a registrable facility.

The Rules define a “registrable facility” as meaning (a) an industrial facility, (b) a commercial facility, (c) an agricultural facility, (d) an institution, and (e) a sewerage facility.

Rule 2 of the Water Pollution Rules defines “water pollutant” as having the meaning assigned to it in rule 3(1). By rule 3(1), for the purposes of these Rules, the parameters or substances at the quality, condition or concentration mentioned in the first Schedule are water pollutants specific to Trinidad and Tobago. The first Schedule item 22 refers to total mercury.

Rule 5 provides that a person shall not release a water pollutant into any water approved by a competent government entity for human consumption without treatment

or with treatment that has been limited solely to disinfection. There is also a prohibition on releasing water pollutants into groundwater where:

- the groundwater is vulnerable to contamination because of the hydrological characteristics of the area under which the groundwater occurs;
- the alternative source of drinking water is available to substantial current or future population;
- the aquifer provides the baseflow for a sensitive ecological system;
- the release of water pollutant may destroy a unique habitat; and
- the groundwater is a current or potential source of drinking water or has some other beneficial use.

The Water Pollution Rules would be relevant to Article 9 of the Minamata Convention which deals with releases of mercury or mercury compounds to water. Rule 3 of the Water Pollution Rules defines a water pollutant. Schedule 1 of the Water Pollution Rules lists the quantity, condition or concentration for the parameter "Total Mercury" which will deem it a water pollutant. Schedule 2 of the Water Pollution Rules lists the permissible limits for the parameter in four receiving environments as shown in Table 23 which also compares these standards with those of the US Environmental Protection Agency and the World Health Organisation (WHO).

Air Pollution Rules 2014[13]

The Air Pollution Rules, 2014 were made pursuant to the EM Act.

The Air Pollution Rules (APR) requires that every operator shall, within six (6) months after the coming into effect of the Rules, submit to the EMA a request in the approved form to register the emitter facility and pay the prescribed fee. In addition, the Rules requires that on the commencement of the Rules, every operator who intends to operate an emitter facility shall, at least ten (10) working days before the commencement of operations, submit to the EMA a request in the approved form to register the facility and shall pay the prescribed fee.

[13] See Legal Notice No. 12 (23rd January 2015). The Rules are referred to in the legal notice as the Air Pollution Rules, 2014.

Table 23: Comparison of permissible levels of mercury in water sources for Trinidad, the United States and the WHO

Trinidad and Tobago Water Pollution Rules					US EPA[14]		WHO[15]
	Receiving Environment						
Parameter or Substance	**Inland Surface Water (mg/L)**	**Coastal Nearshore (mg/L)**	**Marine Offshore (mg/L)**	**Environmentally Sensitive Areas and/or Groundwater (mg/L)**	**Drinking Water (mg/L)**	**Ground water (µg/L)**	**Water (µg/L)**
Total Mercury	0.01	0.01	0.01	0.005			1
Mercury (inorganic)					0.002	2	

The EMA may also require some facilities to apply for and obtain an Air Pollution Permit, which outlines specific conditions for the release of air pollutants in keeping with ambient air quality and stack release limits.

Under the Air Pollution Rules, mercury is classified as an air pollutant.

Schedules 1 and 2 of the APR list the maximum permissible limits for the parameter "mercury and its compounds" which is considered an air pollutant as it meets the definition stated in Rule 2 of the APR; "Air pollutant" means any pollutant released into, or which otherwise has an impact on, the atmosphere or climate and includes:

a) any substance listed in Schedule 1 or Schedule 2 which:

(i) is emitted into the air; and

(ii) causes the maximum permissible level of the parameters listed in Schedule 1 or Schedule 2 to be exceeded;

[14] What are the EPA's Drinking Water Regulations for Mercury? https://safewater.zendesk.com/hc/en-us/articles/212076077-4-What-are-EPA-s-drinking-water-regulations-for-mercury-

[15] Exposure to Mercury: A Major Public Health Concern. http://www.who.int/phe/news/Mercury-flyer.pdf

b) any substance or combination of substances listed in Schedule 1 or Schedule 2 which is emitted into the air; or

c) any emission arising from an activity listed in Schedule 3."

Schedule 3 covers Portland Cement manufacturing, i.e. the manufacture of concrete products as well as waste incineration, which are both specifically stated sources of mercury emissions to be managed under Article 8 of the Convention.

Rule 4 imposes a requirement that an operator who operates an emitter facility is required to register the emitter facility. An emitter facility is defined by Rule 2 as meaning a facility from which an air pollutant is emitted and which is used for an activity listed in Schedule 3.

A person who emits or releases mercury at the quantity or concentration stated in the Schedules of the Air Pollution Rules (APR) and Water Pollution Rules (WPR) is required to submit a source registration application under both regulations. A person who exceeds the permissible levels stated in both regulations may be required to obtain a permit. The names of persons who are source registered or permitted are listed in the National Registers available at the Information Centre at the EMA's Port-of-Spain office.

Customs Act (Chapter 78:01)

The Customs Act governs the import of goods into Trinidad and Tobago and the export of goods from Trinidad and Tobago. Section 2 defines "goods" as including all kinds of goods, wares, merchandise and livestock.

Under Section 44, the President may, by order, prohibit the importation or the exportation of any goods whatsoever. Section 45 sets out a wide range of goods that are prohibited. Section 46 sets out goods that are prohibited from exportation.

Mercury or mercury compounds are not prohibited for importation or exportation under the Customs Act. However, this could be done under the Customs Act (Section 44) and would only require an order under Section 44. No new legislation would be necessary.

Occupational Safety and Health Act (Chapter 88:08)

Section 4(1) of the Occupational Safety and Health Act contains definitions of various words in the Act. The words “occupational disease” is defined as meaning a disease listed in Schedule 1. Among the occupational diseases set out in Schedule 1 are diseases caused by mercury or its toxic compounds (Schedule 1, 1.1.7).

Under Section 6(1) of the Occupational Safety and Health Act, it is the duty of every employer to ensure, so far as is reasonably practicable, the safety, health and welfare at work of all of his/her employees. This duty extends to a range of matters, including:

- the provision and maintenance of plants and systems of work that are, so far as is reasonably practicable, safe and without risks to health;
- arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the handling, storage, and transport of equipment, machinery, articles and substances;
- the provision of adequate and suitable protective clothing or devices of an approved standard to employees who, in the course of employment, are likely to be exposed to the risk of head, eye, ear, hand or bodily injury and the provision of adequate instructions in the use of such protective clothing or devices; and
- the provision and maintenance of a working environment for employees that is, so far as is reasonably practicable, safe, without risks to health and adequate as regards to amenities and arrangements for worker welfare while at work.

Part IV of the Act deals generally with safety in the workplace and what is required by the employer to protect the employee. Additionally, Section 6 of the same Act imposes a general duty on the employer to ensure the health and safety of the employee, with sub-sections 3-6 of Section 6 highlighting those specific duties as it relates to hazardous chemicals. This Act does not specifically define hazardous chemicals, but within its definition for “hazard information”, it refers to “… the use, storage, transport and handling of a dangerous substance”, within which mercury and its compounds would fall.

Section 6(3) makes provision for adequate labelling of hazardous chemicals. Further, Section 6(4) requires that an employer shall ensure that a hazardous chemical is not used or stored in the industrial establishment unless the prescribed requirements containing identification, chemical safety data sheets, and worker instruction and training are met.

According to Section 48, a medical practitioner who, having the opinion that a patient is suffering from one occupational disease contracted in any industrial establishment or in the course of his employment, shall within 48 hours, send the Chief Medical Officer a notification of the occupational disease. In Section 48(2) the Chief Medical Officer shall notify the Chief Inspector.

Part 1 of the Occupational Safety and Health (prescribed forms) Order provides that cases of poisoning by mercury must be reported to an inspector.

Food and Drugs Act

The Food and Drugs Act provides a regulatory framework for food, drugs, cosmetics and devices. Section 2 of the Act defines “cosmetics” as including any substances or mixture of substances manufactured, sold or represented for use in cleaning, improving or altering the complexion, skin, hair or teeth, and includes deodorants and perfumes. Section 2 defines “sell” as including offer for sale, expose for sale, and have in possession for sale and distribution.

Section 14 imposes a prohibition on the sale of harmful or unsanitary cosmetics. In the case of skin lightening creams containing mercury or mercury compounds, such cosmetics could be prohibited under Section 14 where it can be shown that the cosmetic has in or upon it any substance that may cause injury to the health of the user (Section 14a). Section 4 thus prohibits the sale of harmful cosmetics, and this could include mercury containing cosmetics like skin lightening cream.

Section 22 empowers an inspector, when authorized by the Minister, to inspect Custom entries of food, drugs or cosmetics imported into Trinidad and Tobago. By Section 22(3), where it appears from the report of the inspector or the analyst that the sale of the food, drugs or cosmetics would be in violation of the Food and Drugs Act if sold in



Trinidad and Tobago, the food, drug or cosmetic shall not be admitted into the country for use as a drug, food or cosmetic.

Pesticides and Toxic Chemicals Act (Chapter 30:03)

The Pesticides and Toxic Chemicals Act seeks to regulate the importation, exportation, storage, manufacture, sale, use and transportation of pesticides and toxic chemicals, and also to provide for the establishment of the Pesticides and Toxic Chemicals Control Board.

Both “pesticide” and “toxic chemicals” are defined in Section 2 of the Act.

“Pesticide” is defined as any substance which by itself, or in combination with other substances, is proposed or represented, or used for destroying or controlling pests, but does not include any antiseptic, disinfectant, drug or preservative”.

“Toxic chemical” is defined as any chemical, other than pesticides, antiseptics, disinfectants, drugs or preservatives, which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals, and includes all such chemicals irrespective of their origin or method of production or use.

Section 3 of the Act establishes the Pesticides and Toxic Chemicals Board. The functions of the Board are:

- to determine all applications for registrations, licences, and research permits within a reasonable time after the applications are received;
- to grant or cancel registrations, licences or permits in circumstances where the Board deems it fit to do so;
- to advise the Minister on matters relevant to the making of regulations under the Act;
- to advise on the implementation of those regulations; and
- to furnish such returns as the Minister may require.

The following Regulations have been made under the Act:

- Pesticides (Registration and Import Licensing) Regulations (LN225/1987);
- Pesticides (Importation) Regulations (LN 226/1987);
- Pesticides and Toxic Chemicals (Fees for Analysis and Inspection Services) Regulations (LN 74/1993); and
- Toxic Chemicals Regulations (LN 161/2007).

Toxic Chemicals Regulations

Regulation 1 defines “controlled chemical”, “highly toxic chemical”, “toxic chemical” and “toxic industrial chemical”.

A “controlled chemical” is defined as a substance listed in Schedule II. A “highly toxic chemical” is defined as a substance listed in Schedule III which is characterised by a high risk of carcinogenic or teratogenic effects. A “toxic chemical” is defined in the same manner as defined in Section 2 of the Pesticides and Toxic Chemicals Act. A “toxic industrial chemical” is defined as a substance listed in Schedule I whose toxicity is higher than that of highly toxic chemicals for which there are less carcinogenic or teratogenic risks.

Schedule I under item 66, lists mercury and its compounds as a toxic industrial compound. Thus, the provisions of the Toxic Chemicals Regulations would, so far as they relate to toxic industrial chemicals under Schedule I, be applicable to mercury and its compounds.

By regulation 5, any person who wishes to import or manufacture a toxic chemical listed in Schedules I through IV and Schedule VII shall apply to the Board for registration of that toxic chemical. By regulation 9, the Board may refuse to grant approval for registration for a wide range of reasons including that the toxic chemical is not shown to be safe or efficacious when used as recommended (regulation 9(1)(d)), that the use of the toxic chemical is likely to constitute a hazard to public health, domestic animals, bees, fishes, birds or other wildlife or to produce adverse effects to soil, air and water (regulation 9(1)(e)), or that the toxic chemical, or any residue thereof, is so persistent that it may result in long-lasting pollution of the water or land on which it is used (regulation 9(1)(f)).



Under regulation 24(1), waste materials containing toxic chemicals shall be destroyed or disposed of by a method specified by the Registrar so as to prevent any risk to the public or the environment. Further, by regulation 24(2), facilities for the disposal of empty packages and containers, and spilled or waste toxic chemicals shall be such as to avoid contamination of the environment.

By regulation 26(2), toxic chemicals referred to in Schedule I, II, III, IV or VII shall be securely stored by the importer, exporter, manufacturer or user, and all quantities received or removed from stores shall be recorded and signed for by the person responsible for keeping of the stores. Further, access to such stores shall be limited to authorised persons who are aware of the hazards of the toxic chemicals and have been trained in the appropriate safety procedures for such chemicals. The Registrar, under regulation 27, may *inter alia*, issue directions for the person in charge of the workplace to display appropriate warning signs and provide suitable protective clothing for the use of workers engaged in the use, handling or storage of toxic chemicals. In addition, the Registrar may also advise in writing of:

- the manner of use, handling or storage of the toxic chemical so as to prevent any hazard to the health of workers or the public; and
- the manner in which wastes, used storage containers or packages, damaged machines or apparatus are to be disposed of.

Regulation 27(2) confers on the Registrar a general power to issue general directions to manufacturers, wholesalers, retailers and users of toxic chemicals referred to in Schedules I, II, III, IV or VIII concerning the precautions to be taken when such toxic chemicals are used, handled or stored in the workplace.

Under regulation 35, no person shall import a toxic chemical listed in Schedule I, II, III, IV or VIII unless he holds a licence and, where applicable, a permit issued under these regulations.

All applications to import a chemical referred to in Schedule I, II, III, IV or VIII require an application submittal to the Board. The Board, under regulation 35(b), may refuse to

grant a new licence to import a toxic chemical and shall, as soon as practicable, advise the applicant on its reasons for refusal.

Regulation 43 requires that a person who purposes to export a toxic chemical referred to in Schedule I, II, III, IV and VIII shall apply to the Board for a licence to export each shipment of the toxic chemical.

Tobago House of Assembly Act (Ch. 25:03) (rev. 2011)

The Tobago House of Assembly (THA) has responsibility for *inter alia,* environmental matters in Tobago. The THA Act addresses matters such as marine parks and the environment generally. According to the Act, Section 25 states, "Without prejudice to Section 75(1) of the Constitution, the Assembly shall, in relation to Tobago, be responsible for the formulation and implementation of policy in respect of the matters set out in the fifth Schedule". The matters in the fifth Schedule include fisheries and the environment.

Trade Ordinance, 1958

The Trade Ordinance seeks to provide for the maintenance, control, distribution and regulation of supplies and for related purposes. Under the Ordinance, "goods" includes all kinds of goods, produce, wares, merchandise, substances and animals.

By Section 6, regulations made under the provisions of the Ordinance may prohibit the importation or exportation of any goods, or class or description of goods except under the authority of a licence.

Regulation 3(1) of the Imports and Exports Control Regulations prohibits the importation into and exportation from Trinidad and Tobago subject to general or special exemptions as may be approved.

Legal Notice 151 (2013), made pursuant to the Trade Ordinance, sets out the Negative List. This is made pursuant to Section 10 which provides that if any goods are imported or exported in contravention of the Regulations or of a licence, or was brought to any place for the purpose of being exported, then such goods shall be deemed to be prohibited goods. The Negative List could be used for prohibiting the import of mercury.

Standards Act (Chapter 82:03)

The Standards Act provides for the preparation and promotion of standards in relation to goods, services, processes and practices by the establishment and operation of the Bureau of Standards.

Section 3(1) establishes the Trinidad and Tobago Bureau of Standards to be a national standards body and the national laboratory accrediting body. By Section 15(1), the functions of the Board are to promote and encourage the development and maintenance of standards and shall establish standards:

a) for the improvement of goods produced or used in Trinidad and Tobago;
b) to ensure industrial efficiency and development;
c) to promote public and industrial welfare, health and safety; and
d) for the protection of the environment.

This Act can be used to regulate mercury added products listed under Annex I of the Convention as well as processes that use and/or release mercury and its compounds into the environment.

Fisheries Act, 1916

The Fisheries Act seeks to regulate fishing in the waters of Trinidad and Tobago. Its main purpose, together with regulations made thereunder, is to protect and regulate the extraction of the living marine faunal resources of the country. These include fish, crabs, shrimps, turtles and turtle eggs.

Globally, the tendency for mercury to bio-accumulate in fish due to anthropogenic activities has been known to be an area of growing concern. In light of the likely impact on fisheries by mercury, this legislation may be relevant to the Minamata Convention on Mercury.

Public Health Ordinance, 1950

The Public Health Ordinance Chapter 12:4 (1950) contains many provisions that can have an impact on various health issues. The Public Health Ordinance deals with a range of matters including, planning permission, pollution of drains and waterways, and disposal of liquid and solid waste in waterways. As mercury may result in harm to

human health, the provisions of the Public Health Ordinance would be relevant to the effective implementation of the Minamata Convention on Mercury.

Petroleum Act, 1969

The economy of Trinidad and Tobago has a significant dependence on the energy sector. The Petroleum Act and Regulations made thereunder recognise the potential of activities in this sector to cause pollution of watercourses, swamps and marine areas. They cover pollution of areas that are used for fishing, agriculture, navigation and conservation of living resources. They also address pollution of harbours and territorial waters around the country.

As mercury can be released through the extraction, refining and use of petroleum products, this Act is significant to the management of releases from this sector. Regulations can be made to ensure that BAT/BEP are implemented, including the use of mercury emissions controls, and environmentally sound treatment and disposal of mercury containing residues.

Town and Country Planning Act, 1969

The second Schedule, Part IV, clause 8 of the Town and Country Planning Act provides that development plans can make provisions for "prohibiting, regulating and controlling the deposit or disposal of waste materials and refuse, the disposal of sewage and the pollution of rivers, lakes, ponds, gullies and the seashore." The Town and Country Planning Act would be relevant in regard to the siting of contaminated sites.

Summary Offences Act 1921 as Amended 2000

The Summary Offences Act provides for the protection of watercourses by ensuring that no domestic waste is discharged into them. Enforcing this Act can help protect the integrity of all watercourses. Where mercury or a mercury compounds are released into water, then the provisions of Article 9 of the Minamata Convention would be applicable.

Draft Environmental Code, 2000

A draft Environmental Code was prepared in May, 2000. This draft Code was prepared pursuant to Section 19 of the EM Act. In preparing the Code, the EMA was required to:

- undertake a comprehensive evaluation of the written laws and various programmes which address environmental issues; and
- develop and submit to the Minister a draft Environmental Code providing for the overall consolidation, rationalization and modernization of such laws and programmes.

While the draft Environmental Code did address laws that existed in 2000, it does not appear to deal with “programmes” as required by Section 19(1) and (b). In addition, the draft Environmental Code does not contain a separate coherent text providing a rationale for the recommendation for the rationalization and modernization of the laws. The report done in 2000 is now dated as there have been several laws and programmes enacted or approved since that date. Further, it does not specify the need for regulations regarding mercury management.

Draft Waste Management Rules

The improper disposal of hazardous waste has had a major negative impact on coastal areas in Trinidad and Tobago. The EMA has been attempting to develop waste disposal rules with particular reference to hazardous wastes since 2008. The draft Waste Management Rules, 2008 was intended to address all aspects of the hazardous waste cycle and make provision for the storage and disposal of hazardous wastes, and the regulation of landfill sites and incinerators through a permitting process. Rule 12(1) of the Waste Management Rules subject to sub-rule (2) states that no person, including a local authority, must carry out any activity related to the storage, treatment or disposal of hazardous wastes without a waste handling permit granted in accordance with these Rules.

In 2013, the EMA reviewed the draft Waste Management Rules, 2008 with an aim to regulate the management of solid waste. The revision resulted in the development of:

- The Draft Waste Management (Hazardous Waste) Rules, 2014; and
- The Draft Solid Waste (Non-Hazardous) Management Rules, 2014.



Both draft legislations were internally reviewed and it is proposed that new draft legislation will be developed. As of December 2017, a deadline to present the proposed new draft legislation for public comment had not been determined.

3.2.2 Minamata Convention and Trinidad and Tobago's Legislation

This section highlights some of the articles of the Minamata Convention on Mercury that may be relevant as they relate to national legislation should Trinidad and Tobago become a Party (Table 24).

Table 24: Minamata Convention Articles with relation to Trinidad and Tobago's Legislation

Article 2: Definitions	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
Defines relevant definitions including "mercury-added product" as meaning a product or product component that contains mercury or a mercury compound that was intentionally added".	- This definition will need to be added to any legislation which is to be enacted or amended.
Article 3: Mercury supply source and trade[16]	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(3) Not allow new primary mercury mining **(5)** Obtain information on stocks of mercury or mercury compounds exceeding 50 metric tons (MT), and mercury supply generating stocks	- Under the MIA project, it was determined that none of the mercury supply sources and relevant trade stipulated under this article, are relevant to Trinidad and Tobago.

[16] Since this checklist is primarily intended for developing countries, it is assumed that governments will desire control over individual mercury shipments entering the country and thus not provide a general notification of import consent or waive restrictions on the sources of mercury imports under Articles 3.7 and 3.9.

exceeding 10 MT/yr[17] **(5)(b)** Restrict the import and use of excess mercury from decommissioning chlor-alkali plants, and require environmentally sound disposal **(6)(a)** Not allow the export of mercury unless the importing country provides written consent[18], the mercury is for an allowed use or environmentally sound storage, and all other conditions of Article 3.6 are met[19] **(8)** Restriction on mercury imports	
Article 4: Mercury-added products Article 2 defines "mercury-added product" as meaning a product or product component that contains mercury or a mercury compound that was intentionally added.	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(1) Not allow the manufacture, import, and export of products listed in Part I of Annex A not otherwise excluded following the phase out date listed in the Annex[20]	- It is to be noted that none of the measures require legislative support given the broad scope and flexibility of the measures. It is expected that Trinidad and Tobago would be able to implement two or more of the listed measures. Article 4 (1) speaks of "taking appropriate measures". Such measures are not defined in this Article, but would likely include policies and legislation. Apart from regulations for pesticides, no legislation has yet been enacted in respect of the phase out of the mercury-added products specified in Annex A, Part I. - Instead of "taking appropriate measures" to phase out the mercury-added products listed in Part I of Annex A, a Party may, at the time of ratification or upon entry into an amendment to Annex A for it, indicate that it will implement the strategies to address products listed in Part
(3) Phase down the use of dental amalgam through two or more measures	

[17] See Article 3.1 for definition of mercury compounds in this context.
[18] A national focal point for trade-related consent must be designated under Article 17.4 of the Convention.
[19] Governments may consider adoption of a mercury trade licensing system to meet the PIC requirements, the source/use restrictions, and the reporting obligations of Article 3
[20] The prohibition date must be consistent with Articles 4 and 6 of the Convention.

listed in Part II of Annex A	I of Annex A (see Article 4 (2)). To avail itself of the Article 4 (2) alternative, a Party would have to demonstrate two matters: o that it has already reduced to a minimal level the manufacture, import, and export of the large majority of the products listed in Part I of Annex A; and o that it has implemented measures or strategies to reduce the use of mercury in additional products not listed in Part I of Annex A at the time it notifies the Secretariat of its decision to use this alternative. - Article 4 (1) could be implemented either by issuance of appropriate standards under the Standards Act (Chapter 82:03) or by amending the provisions under Section 45 of the Customs Act that deals with the prohibition of goods to be imported, to include mercury and mercury compounds. - Under the Toxic Chemicals Regulations, mercury and mercury-added products are treated as "toxic industrial chemicals" (see Toxic Chemicals Regulations, Schedule I, item 66). - Under regulation 43 of the Toxic Chemicals Regulations (made pursuant to the Pesticides and Toxic Chemicals Act), the export of mercury is not allowed except under a licence granted by the Board. The Board has the discretion to allow or refuse the export of mercury. - The Food and Drugs Act can be used to restrict the import of mercury-added cosmetics; particularly those containing more than 1ppm as recommended by the Convention.
Article 5: Manufacturing process in which mercury or mercury compound is used	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(2) Not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part I	- Currently, no such processes occur in Trinidad and Tobago, however, should such processes develop in the future, the manufacturing facilities would be bound to the

of Annex B[21]	stipulations under Article 5 and be subject to the requirements stated under the Environmental Management Act (Chapter 35:05).
Article 6: Exemptions available to a Party upon request	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
Article 6 states that a "State or regional economic integration organization may register for one or more exemptions from the phase-out dates listed in Annex A or Annex B…".	- If such exemptions are deemed necessary, the State must notify the Secretariat in writing, with an explanation, on becoming a Party to the Convention. Other stipulations for requesting exemptions are detailed in the Article.
Article 8: Emissions Article 8 defines "emissions" as meaning emissions of mercury or mercury compounds to the atmosphere.	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
Require control and, where feasible, reduce emissions of mercury and mercury compounds, often expressed as "total mercury" to the atmosphere through measures to control emissions from point sources falling within the source categories listed in Annex D	- Section 49 of the **Environmental Management Act** (Chapter 35:05) establishes a statutory framework for air pollution. - Section 49(1) requires the EMA "to investigate the environment generally and such premises and vehicles as it thinks necessary for the purpose of: • ascertaining the extent of air … pollution and the significant sources of pollution which by their release cause or contribute to such pollution; and • characterising or describing that pollution." - Section 49(2) requires the EMA to maintain a register of air and noise pollution as prescribed by Rules. - The **Air Pollution Rules, 2014** are applicable and lists permissible levels for mercury or its compounds for ambient air and stock emissions and is relevant to the implementation of Article 8 of the Minamata Convention.

[21] In this context, mercury compounds are defined broadly under Article 2(e). Governments with existing factories may elect to phase out the use of mercury, and prohibit any new factories. The choice of phase out date must be consistent with Articles 5 and 6 of the Convention.

Article 9: Releases	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(5) Take one or more measures below to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies • release limit values to control and, where feasible, reduce releases from relevant sources; • the use of best available techniques and best environmental practices to control releases from relevant sources; • a multi-pollutant control strategy that would deliver co-benefits for the control of mercury releases; and • alternative measures to reduce releases from relevant sources.	- Sections 53 and 54 of the **Environmental Management Act**, coupled with the provisions of the **Water Pollution Rules**, would satisfy the requirements of Article 9. - In respect of releases of mercury and mercury compounds into land, there are no provisions in the **Environmental Management Act** which specifically addresses this issue. Thus, legislative or policy measures would be necessary to deal with this requirement.
Article 10: Environmentally sound interim storage of mercury other than waste mercury	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(1) Applies to the interim storage of mercury and mercury compounds as defined in Article 3 that do not fall within the meaning of the definition of mercury wastes set out in Article 11. **(2)** Take measures to ensure interim mercury storage is conducted in an environmentally sound manner, taking into account guidelines to be developed by the Conference of the Parties	- Under the MIA Project, it was determined that stocks and storage of mercury and mercury compounds as defined in Article 3 are not relevant to Trinidad and Tobago. However, in the event that it becomes relevant in the future, the following would apply: - Under regulation 17 of the **Toxic Chemicals Regulations**, there is a prohibition on the storage of toxic chemicals in marketable quantities except in premises registered by the Board for storage of chemicals. Regulation 17(2) requires that an application be made to

(COP)[22]	the Board where toxic chemicals are to be stored in accordance with regulation 17(1). Under regulation 18(1), where an application for the registration of storage of toxic chemicals has been made, the Registrar shall arrange for an inspection of the premises by an inspector, an analyst, and a medical examiner who shall prepare a report to be submitted to the Board. Upon consideration, the Board may require that alterations of the premises shall be made. Regulation 19 of the Toxic Chemicals Regulations allows the Board to register the premises for storage of toxic chemicals where the Board is satisfied that the premises are suitable for the storage of toxic chemicals. - Part V of the **Toxic Chemicals Rules** also contains requirements for premises registered for the storage of marketable quantities of toxic chemicals for the purpose of sale, packaging or manufacture. These include requirements for the construction of such premises (Rules 23). - Regulation 24 of the **Toxic Chemicals Regulations** provides that waste materials containing toxic chemicals shall be destroyed or disposed of by a method specified by the Registrar so as to prevent any risk to the public or the environment. Part XI of the Toxic Chemical Regulations provides for the transport of toxic chemicals. - The **Basel Convention**, to which Trinidad and Tobago is a Party, makes reference to the environmentally sound management of hazardous waste. However, there is no legislation in Trinidad and Tobago to implement the provisions of the Basel Convention into its domestic legislation. Thus, at present, the provisions of the Basel Convention are not legally enforceable in Trinidad and Tobago. - Sections 55 and 56 of the **Environmental Management Act** deal with aspects of waste management. Section 57

[22] The authority may address areas such as quantity limits, duration, best practices, reporting, etc.

	addresses the issue of waste management permits, and section 57(4) requires that a person shall apply to EMA for the grant of the licence or permit as prescribed by Rules. So far, waste management rules have not yet been prescribed. Section 58 of the Environmental Management Act provides that no person shall handle or dispose of any waste or hazardous waste in a manner which is in violation of any applicable licence, permit, standards, conditions or requirements under this Act. - **Draft Waste Management Rules** have been prepared but not finalized, and such Rules are not in force. The Draft Waste Management Rules would have to be promulgated before Trinidad and Tobago would be in compliance with Article 10.
Article 11: Mercury wastes	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(3)(a) Take measures to manage mercury wastes in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirements to be developed. **(3)(b)** Take measures to restrict mercury derived from the treatment or re-use of mercury waste to allowed uses under the Convention or environmentally sound disposal **(3)(c)** Require transport across international boundaries in accordance with the Basel Convention, or if the Basel Convention does not apply, consistent with international rules, standards, and guidelines.	-Sections 55 and 56 of the **Environmental Management Act** deal with aspects of waste management. Section 57 addresses the issue of waste management permits and at section 57(4), requires that a person shall apply to EMA for the grant of the licence or permit as prescribed by the Rules. So far, **Waste Management Rules** have not yet been prescribed, and there is no legislation that implements the Basel Convention or its guidelines. -Regulation 24 of the Toxic Chemicals Regulations provides that waste materials containing toxic chemicals shall be destroyed or disposed of by a method specified by the Registrar so as to prevent any risk to the public or the environment. Part XI of the Toxic Chemical Regulations provides for the transport of toxic chemicals.

Article 12: Contaminated Sites	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(1) Develop strategies for identifying and assessing mercury/mercury compound contaminated sites	- Section 61 of the **Environmental Management Act** makes provision for the Authority to investigate and designate "categories of circumstances involving accidental spills, other releases of pollutants, or other incidents with respect to hazardous substances which may present a risk to human health or the environment." Section 61 (4) allows the EMA to investigate and evaluate any such release or incident, to respond to the incident and to develop appropriate environmental programmes, standards, conditions, permits, licences, etc. designed to avoid such releases or incidents in the future. - Through the Town and Country Planning Act (1969), development plans can make provisions to regulate the disposal of mercury containing wastes and the establishment of potentially mercury contaminated sites. - The combined effect of the **Certificate of Environmental Clearance** (designated activities) **Order** and the **Certificate of Environmental Clearance Rules** would address the issue of the remediation of existing contaminated sites. However, Article 12 is a permissive provision and does not contain mandatory provisions for a Party to establish a regulatory framework to manage contaminated sites. Article 12 only encourages Parties to develop appropriate strategies for the identification and assessment of sites contaminated by mercury or mercury compounds. - Under the MIA project, an assessment of potentially contaminated sites has been conducted in order to inform the Government.[23]

[23] Included in Section 2.2 of this MIA Report

Article 16: Health Aspects	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(1)(a) Promote the development and implementation of strategies to identify and protect populations at risk from exposure to mercury and mercury-based compounds **(1)(b)** Promote the development and implementation of educational programmes on occupational exposure to mercury and mercury compounds **(1)(c)** Promote appropriate healthcare services for prevention, treatment and care of populations affected by the exposure to mercury or mercury compounds **(1)(d)** Address the need to establish and strengthen the appropriate institutional and health professional capacities for the prevention, diagnosis, treatment or monitoring of health risks related to the exposure to mercury and mercury compounds	- Section 6 of the **Occupational Health and Safety Act** also imposes a general duty on every employer to ensure, as far as is reasonably practicable, the safety, health and welfare of all his employees. These requirements are set out in greater detail in section 6 (2). - Section 6 (4) of the **Occupational Health and Safety Act** specifically requires that an employer shall ensure that a hazardous chemical is not used, handled or stored in the industrial establishment unless the prescribed requirements concerning identification, chemical data sheets, and worker instruction and training are met. Section 7 imposes a duty on all employees to ensure that persons in their employment are not exposed to risks to safety or health. - Part IV of the **Occupational Health and Safety Act** also contains comprehensive provisions in regard to the safety of employees.

3.3 Policy and Legislative Gap Analysis

There are several gaps in Trinidad and Tobago's existing policies, legislation and institutional framework regarding mercury and its environmentally sound management. These include:

1. Currently, no subsidiary legislation has been promulgated to deal with waste in Trinidad and Tobago, however relevant waste rules have been drafted. Promulgating such rules relating to wastes in accordance with Section 55 of the Environmental Management Act could address the requirements of Article 11 (3) of the Minamata Convention on Mercury which requires that each Party shall take appropriate measures in respect of mercury waste.

   As of December 2017, in the absence of specific Waste regulations,[24] the EMA currently regulates the management of wastes through the Certificate of Environmental Clearance (CEC) Rules or through Consent Agreements. One of the conditions normally written in CECs or Consent Agreements issued by the EMA in the Notice of Violation process is to ensure the environmentally sound management of wastes. If the scope of the person's operations includes the generation and/or treatment of mercury wastes, then it is expected that the person handles same in an environmentally sound manner. The EMA will monitor compliance with the agreed mitigation measures.

2. Mercury import and export is not regulated in Trinidad and Tobago. However, the Import and Export Negative List of the Trade Ordinance can be utilized to regulate the import or export of mercury and mercury-added products listed in Article 4 of the Minamata Convention on Mercury. Also, the import or export of mercury and mercury added products could be prohibited under Section 44 of the Customs Act. Another option is to implement provisions for the allowance of the import and export of mercury through specific amendments to the Pesticides and Toxic Chemicals Act and the Toxic Chemicals Regulations which will aid in the

[24] The Waste Rules are currently being developed by the EMA.

compliance of Article 3 (6) and 3 (8) of the Minamata Convention which requires Parties not to allow the import of export of mercury.

3. There are presently no regulations on the control of releases of mercury and mercury compounds to land. The proposed Waste Management Rules can be used to control releases to land in accordance with Sections 55 to 58 of the Environmental Management Act.

3.3.1 Recommendations for Policy and Legislation Action

The major recommendations for Trinidad and Tobago to fill the identified legislative gaps and to promote environmentally sound mechanisms for mercury management are shown in Table 25. These are medium-term recommendations and are expected to take 12-18 months to be implemented. It is suggested that these actions be completed by 2019.

Table 25: Legislative recommendations for Trinidad and Tobago

Legislation	Recommendation
Environmental Management Authority Act	Promulgate the Waste Management Rules in accordance with Section 55 of the Environmental Protection Act.
	Amend the Environmental Management Act (or promulgate Rules under the Act) to control the releases of mercury and mercury compounds to land.
Toxic Chemicals Regulations	Amend Regulation 35 of the Toxic Chemicals Regulations to provide that the import of mercury or mercury compounds is prohibited and that no licence can be issued for the import of mercury or mercury compounds.
	Amend Regulation 35 of the Toxic Chemicals Regulations to provide strict stipulations to the export of mercury or mercury compounds.
Standards Act (Chapter 82:03)	Issue appropriate standards for products (especially skin lightening cosmetics) listed under Annex A, Part I and Part II of the Minamata Convention to ensure compliance with the Convention's obligations.
Customs Act	Amend the provisions under Section 45 of the Customs Act that deals with the prohibition of goods to be imported, to include mercury and mercury compounds in accordance with Annex A of the Minamata Convention.

Trade Ordinance	Goods containing mercury compounds could be listed under the Import Negative List which is provided for under the Trade Ordinance

3.4 Institutional Assessment

This section includes an assessment of some of the key institutions that are relevant to the management of mercury issues.

3.3.1 Key Institutions

Ministry of Planning and Development

The Ministry of Planning and Development is the line Ministry for the Environmental Management Authority. The Environmental Policy and Planning Division is located in this Ministry, and would be responsible for the Minamata Convention, if Trinidad and Tobago were to become a Party, since Multilateral Environmental Agreements (MEAs), such as the Basel Convention, are coordinated by the MEA Unit within this Division.

Environmental Policy and Planning Division (EPPD)

The EPPD has been responsible for the management of plans, strategies and national policies aimed at alleviating issues affecting the environment. These include:

- The National Implementation Plan for Trinidad and Tobago;
- The implementation of Stockholm Convention on Persistent Organic Pollutants;
- The implementation of the Basel Convention;
- The Strategies for Reduction of Carbon Emissions in Trinidad and Tobago, 2010;
- The National Forest Policy;
- The National Protected Areas Policy;
- The National Waste Recycling Policy;

- The Draft National Wildlife Policy; and
- The National Climate Change Policy.

Environmental Management Authority (EMA)

The EMA is a statutory body established by the Government of Trinidad and Tobago to address the country's environmental problems. The EMA seeks to provide a comprehensive and integrated framework for protecting, conserving and enhancing the environment of Trinidad and Tobago. The EMA facilitates cooperation towards environmental management among Government Agencies, NGOs and community-based organisations. The EMA is mandated to write and enforce laws and regulations for environmental management, to educate the public about the nation's environmental issues and to control and prevent pollution, as well as conserve natural resources.

Under the Environmental Management Act, the general functions of the EMA are to:

- make recommendations for a National Environment Policy;
- develop and implement policies and programmes for the use of the environment consistent with the objects of the Environmental Management Act;
- coordinate environmental management functions performed by persons in Trinidad and Tobago;
- make recommendations for the rationalization of all government entities performing environmental functions;
- promote educational and public awareness programmes on the environment;
- develop and establish national environmental standards and criteria;
- take all appropriate action for the prevention and control of pollution and conservation of the environment;
- establish and coordinate institutional linkages locally, regionally and internationally;
- perform such actions as prescribed; and
- undertake anything incidental or conclusive to the performance of any of the foregoing functions.

The EMA, in conjunction with the Ministry of Health, the Institute of Marine Affairs and the Water Resources Agency can also identify issues of water quality and monitor marine life for contamination.

The Tobago House of Assembly

The Tobago House of Assembly has a number of divisions. These are:

- Office of the Chief Secretary;
- Community Development, Enterprise Development and Labour;
- Education, Innovation and Energy;
- Finance and the Economy;
- Food Production, Forestry and Fisheries;
- Health, Wellness and Family Development;
- Infrastructure, Quarries and the Environment;
- Settlements, Urban Renewal and Public Utilities;
- Sports and Youth Affairs; and
- Tourism, Culture and Transportation.

The Division of Infrastructure, Quarries and Environment has responsibility for the following:

- construction, development and maintenance of road network and drainage systems;
- construction and maintenance of public buildings and facilities;
- production and sale of quality rock products and asphalt transport and traffic management; and
- environmental management and protection.

The Department of Environment is charged with the protection, prevention and enhancement of Tobago's environment. The Department also promotes sustainable use and management of Tobago's natural resources. The Department carries out the processing of environmental permits in accordance with the EM Act including CEC Rules, water pollution permits and air pollution permits through a Memorandum of



Understanding with the EMA. The Department also undertakes general environmental monitoring of noise levels, air quality, water quality and wetlands.

Trinidad and Tobago Solid Waste Management Company

The Solid Waste Management Company (SWMCOL) is a State Enterprise that is responsible for the management of three (3) of the five (5) waste disposal sites in Trinidad and Tobago. The 5 main public disposal sites are:

- Beetham Landfill (managed by SWMCOL);
- Guanapo Landfill (managed by SWMCOL);
- Guapo Landfill (managed by the Point Fortin Borough Corporation);
- Forres Park Landfill (managed by SWMCOL); and
- Studley Park Landfill, Tobago (managed by the Tobago House of Assembly).

In Trinidad and Tobago, the Municipal Corporations are responsible for door-to-door collection of domestic household waste. The waste is then taken to the various landfills within the country.

There is no separation of household hazardous waste or special wastes, such as medical waste, pollution control waste or industrial process waste. Therefore, wastes which contain mercury, such as bulky waste, are likely to end up in these landfills.

At the moment the SWMCOL has no designated facilities to deal with the disposal of hazardous waste.

Trinidad and Tobago Bureau of Standards

The Trinidad and Tobago Bureau of Standards (TTBS) is a corporate body established by the Act of Parliament. The TTBS has as its major objectives to establish standards and to promote their development and maintenance.

The primary role of the TTBS is to develop, promote and enforce standards in order to improve the quality and performance of goods produced or used in Trinidad and Tobago as well as to ensure industrial efficiency and development, and to promote public and industrial welfare, health and safety and protect the environment.

In addition, the TTBS engages in a range of conformity assessment activities, instituting a national quality system, and providing advisory and educational programmes in connection with standards. The TTBS is also involved with national standards, regional standards and international standards, as well as the standards development process.

Customs and Excise Division

The Customs and Excise Division has responsibility for the implementation of the Customs Act. The key roles of the Customs and Excise Division are:

- revenue collection and protection;
- the correct application of trade policy (i.e. monitoring compliance with trade related rules and agreements in order to facilitate legitimate trade); and
- protecting the physical borders of Trinidad and Tobago and the environment (i.e. combating smuggling, enforcing health standards and environmental policy and laws).

Ministry of Energy and Energy Industries

The Ministry of Energy and Energy Industries is responsible for the overall management of the oil, gas, and mineral sectors in Trinidad and Tobago. In this context, the Ministry is responsible for monitoring and controlling the energy and mineral sectors of Trinidad and Tobago. Among the wide range of functions exercised by the Ministry are the following:

- leasing/licensing of areas for petroleum exploration and production;
- regulating and managing upstream operations in oil refining activities; and
- planning, developing and implementing long-term policy initiatives in the petroleum sector.

The Ministry of Health

The Ministry of Health is a key entity in ensuring the protection of the population's health and in ensuring that all organisations and institutions that produce health goods and services conform to standards of safety. The regional health authorities are the main bodies under the Ministry of Health that are responsible for the provision of health care

services. While the health authorities are autonomous, the Ministry assists in setting policies, goals and targets for the regions based on assessment of real health needs.

Chemistry, Food and Drug Division

The Chemistry Food and Drugs Division, under the Ministry of Health, seeks to:

- ensure safe quality of an equitable standard for use by consumers of food, drugs, cosmetics and medical services;
- ensure safety in use, the proper management and acceptable standards for pesticides and toxic chemicals; and
- provide technological and laboratory services in the area of food, drug, cosmetics, medical devices, pesticides and toxic chemicals.

The Division is the body responsible for the administration of the Food and Drugs Act and Regulations, and the Pesticides and Toxic Chemicals Act and Regulations. The Chemistry Food and Drugs Division is comprised of three main units:

- Food and Drugs Inspectorate;
- Pesticides and Toxic Chemicals Inspectorate; and
- Laboratory Service.

Of particular relevance to the Minamata Convention would be the Pesticides and Toxic Chemicals Inspectorate as they are responsible for administering the Pesticides and Toxic Chemicals Act, and the Food and Drugs Inspectorate which can oversee regulation of mercury containing cosmetics.

Occupational Safety and Health Authority

The Occupational Safety and Health Authority (OSHA) is primarily concerned with the Occupational Safety and Health Act, 2004. OSHA carries out various functions including its regulatory function, i.e. enforcement of the Occupational Safety and Health Act. It also has an investigative function in respect of accidents and complaints in industrial establishments as defined by the Occupational Health and Safety Act. It also has an advisory function, and in this regard, advises state agencies including the TTBS, EMA, Tourism Development Company, Customs and Excise Division, Local Health Authorities

and Town and Country Planning Division on matters of Occupational Safety and Health in respect to new factory buildings and institutions. OSHA also provides data to stakeholders including the International Labour Organization and the Inter-Governmental Forum on Chemical Safety.

Fisheries Division (Ministry of Agriculture, Land and Fisheries), the Department of Marine Resources and Fisheries (THA), and the Institute of Marine Affairs

The Fisheries Division of the Ministry of Agriculture, Land and Fisheries; the Marine Resources and Fisheries Department of the Division of Agriculture, Marine Affairs and the Environment of the Tobago House of Assembly and; the Institute of Marine Affairs (IMA) are the agencies with primary responsibility for regulating the fisheries sector and for applied research and information gathering for the development and management of fisheries in Trinidad and Tobago.

3.3.2 Institutional Challenges and Priorities

It appears that the institutional challenges in Trinidad and Tobago in order to mitigate future mercury pollution revolve around some critical cross-cutting issues, spanning three (3) broad institutional thematic areas, as follows:

- Roles of institutional arrangements for assessing risks for unsound use, management and release of mercury in the environment;
- Coordination, coherence and synergies; and
- Data and knowledge sharing.

The Minamata Initial Assessment and progress on current work on the Minamata Convention on Mercury will considerably enhance data on mercury. Table 26 below summarizes, the cross-cutting issues related to mercury under each thematic area.

Institutional mechanisms should exist at different levels within Trinidad and Tobago to mitigate the impact of mercury on the environment, specifically at the legislative and policy levels.



Table 26: Institutional cross-cutting issues related to mercury in Trinidad and Tobago

Roles of Institutional Arrangements for Assessing and Managing Risks for Implementation of the Convention	Coordination, Coherence and Synergies
• Providing scientific advice; • Providing policy guidance; • Generating research; • Sharing research and best practices; • Generating data, observations and monitoring; and • Mainstreaming the consideration of the Minamata Convention on Mercury into existing policies and process.	• Need for better coordination between the institutions, their portfolio Ministries, Departments and Agencies.
Data and Knowledge Sharing	
• No overarching system, arrangement, institution or process for collecting, exchanging or disseminating relevant knowledge among stakeholders.	

Table 27 highlights a proposed framework for addressing institutional challenges related to the implementation of the Minamata Convention on Mercury.

Table 27: Proposed institutional framework for addressing institutional challenges for the implementation of the Minamata Convention on Mercury

Area	Proposed Aim
Core Institutional Challenge	To build leadership, trust and mutual accountability in advancing the transitions to low mercury releases in Trinidad and Tobago.
Governance and Accountability	To establish credible, inclusive and effective governance arrangements.
Designated National Agencies	To establish a common approach to establishing nation-level co-ordination and implementation functions.
Implementation Measures	To establish flexible, inclusive approaches to developing generally-accepted methods that can support the implementation of the Minamata Convention on Mercury.

Inter-Agency Committee

There is a need to establish an inter-agency committee for the implementation of the Minamata Convention on Mercury.

Trinidad and Tobago has already established a special purpose vehicle in the form of a National Working Group to allow for inter-sectoral coordination and management of the activities under the MIA project. The Lead Agency (EPPD) has the responsibility for



collaboration and partnership with relevant representatives' organizations comprising national government departments, agencies, and other stakeholder organizations with representatives from: academia, private sector organizations, research institutions, manufacturing associations, civil society groups, NGOs, and CBOs to achieve the project development objectives to enable ratification/ implementation of the Convention. This working group can be continued post-project and be structured as described in this section of the report.

Within the EPPD, a National Supervisor is assigned who is the main point of contact responsible for coordination, and implementation arrangements for the Minamata Convention; has responsibility for collaborating with, and appointing, the relevant key agencies, and other stakeholder organizations for providing leadership; and has accountability for implementing the enabling activities for the Minamata Convention on Mercury and achieving the related project development objectives on a timely basis and within budget.

The National Supervisor would provide leadership and direction to the working group members through all aspects of the activities to be undertaken. As such, the appointment of representative organizations to the working group would be guided by the level of oversight management that is required for the implementation of the Minamata Convention on Mercury.

By co-opting relevant member organizations on the working group, the Focal/Lead Agency receives guidance and technical assistance to further assist it in its work.

Table 28 highlights the representative organizations that are members on the National Working Group at the various national levels, and describes the roles and responsibilities that each is expected to play in coordinating the effective implementation of the various components and sub-components of the Minamata Convention on Mercury.

Table 28: Proposed steering committee/ inter-agency committee representative organizations

Proposed Steering Committee Representative Organizations	Summary of Overall Responsibilities and Potential Role under the Minamata Convention on Mercury
Ministry of Planning and Development (Chair) **(Environmental Policy and Planning Division)**	▪ Focal Point for Multilateral Environmental Agreements (MEAs) and issues related to the Environment ▪ Formulates Policy ▪ Oversight of implementation ▪ Preparing drafting instructions
Environmental Management Authority	▪ Regulatory control related to air pollution, water quality; ▪ Guidelines and standards for mining; ▪ Permits & Licences; ▪ Monitors impacts; ▪ Certificate of environmental clearance rules; ▪ Environmental impact assessments.
Customs and Excise Division	▪ Determines whether mercury and mercury-based products allowed to be imported and issue licences to import; ▪ Provides guidance on intended use of the products to be imported; ▪ Monitors imports and prevents illegal imports; ▪ Stores products until released to importer or distributor.
Trinidad and Tobago Solid Waste Management Company (SWMCOL)	▪ Proper waste disposal of mercury & mercury-related products and other hazardous materials at landfills (for example thermometers, blood pressure machines, dental amalgams, fluorescent lamps, batteries); ▪ Disposal of containers; ▪ Recycle mercury, ferrous metals and others ▪ Export wastes, where required.
Ministry of Health (and its agencies)	▪ Regulates environmental health; ▪ Regulates import and export of chemicals; ▪ Food and drugs regulations; ▪ Biocides and pesticides with mercury; ▪ Regulation of pesticides and other toxic chemicals; ▪ Pharmaceuticals for human/veterinary use; ▪ Dental mercury-amalgam fillings; ▪ Manometers and gauges; ▪ Laboratory chemicals and equipment; ▪ Provides guidance on procedures to be followed when handling chemicals and other hazardous materials.
Council of Presidents of the Environment	▪ Advocacy and special interest; ▪ Community based organization ▪ Social issues
Trinidad and Tobago Manufacturers Association	▪ Private sector connected with promoting and developing manufacturing industries locally. ▪ Aims to safeguard interest of local manufacturers and acts as a liaison with Government in the development of relevant policies.

Proposed Steering Committee Representative Organizations	Summary of Overall Responsibilities and Potential Role under the Minamata Convention on Mercury
Ministry of Energy and Energy Industries	▪ Regulation of players; ▪ Permits and licences ▪ Guidelines and standards for operations in the sector;
Trinidad and Tobago Electricity Commission	▪ Issues with electrical switches and relays with mercury; ▪ Light sources with mercury; ▪ Generation, transmission and distribution of electricity throughout Trinidad and Tobago.
Tobago House of Assembly Department of Environment	▪ Promotes public awareness, education and sensitization programmes related to environmental matters in Tobago/general responsibility for the environment for Tobago.
BCRC – Caribbean	▪ Provides technical support on the implementation of the Minamata Convention on Mercury.

Chapter 4: Identification of Populations and Risk and Gender Dimensions

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

Exposure to elemental mercury and mercury compounds can pose a higher risk to certain populations and targeted groups that are more sensitive to its effects. These groups include:

- Women of childbearing age;
- Pregnant women;
- Foetuses;
- Newborns; and
- Young children (less than 12 years of age).

Pregnant women and women of childbearing age are considered to be high risk groups since their exposure to mercury can impact the foetus. The sensitivity of the developing system of foetuses, newborns and young children can enhance the dangerous impacts of the toxic effects of mercury. Similarly, individuals with preconditions, such as diseases of the liver, kidney, lung and nervous system may be at risk of suffering at this same higher intensity.

Certain groups are exposed to higher levels of mercury, either through a regular diet of fish and aquatic organisms, particularly larger predatory marine animals, occupational or environmental exposure, or through the consistent use of mercury-added products. 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.



4.1.1 Mercury Exposure to Humans through Seafood[25]

Trinidad and Tobago is considered one of the small island developing states (SIDS). Some of the country's population is concentrated along the coast, and fish is a staple food for most of its communities. Methylmercury, the organic form of mercury, biomagnifies in aquatic food webs and can therefore affect the population based on consumption.

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, 2010; 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 the people of Trinidad and Tobago, there is a higher risk of exposure to mercury as the mercury bioaccumulates in the aquatic species. Health and environment 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 the recommended dose.

Table 29 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

[25] Seafood includes marine and freshwater fish and shellfish, as well as marine mammals.

meal size of about 6 ounces (170 gm). 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 29: US EPA guidance for seafood consumption based on mercury concentrations

Mercury in Seafood (ppm, wet weight)	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.

There is inconclusive data on mercury contamination of fish species harvested from Trinidad and Tobago. However, given literature reports that Tilapia, lobster and other small individuals may have average mercury concentrations under 0.22 ppm, ww; and conversely, large pelagic, predatory and long-lived species like King Mackerel, Shark and Swordfish may have mean mercury levels that exceed 0.9 ppm. It is therefore recommended that smaller species be consumed either on a daily or weekly basis, while consumption be limited to only one (1) meal per month for the larger species as they are considered to be riskier choices.

The monitoring of mercury in fish and seafood in Trinidad and Tobago 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

Populations involved in professions that expose them to elemental mercury or mercury compounds are at a higher risk due to the increased frequency of exposure. The potential occupations at risk and the relevant pathways are described below (Table 30).

Table 30: Occupational exposure to mercury in Trinidad and Tobago

Occupation	Cause of potential mercury exposure
Waste collectors, medical waste incinerator workers and landfill workers	• Handling of end-of-life mercury containing products from households and hospitals, including fluorescent light bulbs, batteries, cosmetics, and electrical switches and relays • Incineration of mercury containing products
Dental professionals including dental assistants	• Preparation, use and disposal of dental amalgam fillings • Use and handling of mercury-containing medical equipment
Medical professionals	• Handling of mercury-containing medical equipment such as thermometers or sphygmomanometers • Clean-up of damaged or broken equipment
Environmental/enforcement officers	• Identification, monitoring and evaluation of mercury-containing products and potentially contaminated sites
Firemen and first responders to chemical accidents	• Clean-up of mercury-containing chemicals and products
Laboratory workers	• Use and clean-up of mercury-containing chemicals
Other industrial workers	• Inhalation of mercury-contaminated particles from waste incineration facilities, etc

People living in areas that are more susceptible to environmental contamination by mercury are also more likely to be affected by mercury exposure. These higher risk areas are typically around hot spots and point sources of uncontrolled mercury releases such as landfills and other waste disposal sites, cement production facilities, oil and gas

refineries, waste incineration facilities and other industrial facilities that release mercury and mercury compounds into the environment. Point sources of mercury release should implement controls to reduce emissions to the environment, and decrease the risk to nearby residents.

4.2 Assessment of Potential Gender Dimensions Related to the Management of Mercury

The Basel, Stockholm, Rotterdam and Minamata Conventions have highlighted the importance of ensuring gender mainstreaming in countries in order to implement these Conventions. 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).

Gender mainstreaming is also a critical component for countries to achieve gender equality; that is, a society where "the interests, needs and priorities of both women and men are taken into consideration" and where "the diversity of different groups of women and men" is recognized. Gender equality is listed as one of the United Nations Sustainable Development Goals.

Mercury exposure to men and women vary due to differences in the frequency of contact through gender-determined occupational and household roles, and cultural practices. The health impacts resulting from exposure also varies between men and women as a result of physiological differences that make women more sensitive to the effects of the toxic compound. It is therefore important to consider the differing roles of gender with regards to the exposure and management of mercury, and to ensure that gender considerations are effectively mainstreamed into any future mercury management plans.

An extensive survey and assessment of gender issues related to mercury exposure in Trinidad and Tobago is not yet defined, however, a descriptive summary was developed to broadly apply across the country's populations relating to general exposure and gender risks within various sectors where mercury contamination is likely to occur. Exposure to mercury in Trinidad and Tobago is expected to occur through fish consumption, household use and disposal of mercury-added products (MAPs), occupational exposure to mercury and its compounds, and the use of skin lightening creams containing mercury.

It was noted that while mercury exposure from fish consumption and domestic use of MAPs did not vary between sexes, the health risk was greater in pregnant women and women of childbearing age who posed a greater risk of exposure to their offspring. The nervous systems and brains in fetuses and young children may be more vulnerable than adults to methylmercury as they are still in the developing stages.

Assessments to identify potential gender dimensions are useful when considering training, education, and awareness-raising strategies regarding mercury exposure as they allow for the development of more gender-sensitive communication strategies that can target the sexes differently in order to benefit all genders equally and achieve maximum benefit in Trinidad and Tobago.

4.2.1 Occupational Exposure

According to data from the Trinidad and Tobago Central Statistical Office, female participation in the labour force was below male participation for the years 2014-2017 (Table 31).

Table 31: Trinidad and Tobago's labour force participation rates by gender

Year	Male Percentage	Female Percentage
2017	57%	43%
2015	58%	42%
2015	59%	41%
2014	58%	42%

While it is evident that a greater portion of men are employed in Trinidad and Tobago, gender differentiation among workers in various occupational roles still needs to be taken into consideration since certain jobs that may expose workers to higher levels of mercury, may be more oriented towards women and vice versa. Table 30 showed the occupations in Trinidad and Tobago that potentially expose workers to mercury.

As Trinidad and Tobago's inventory results showed extraction and use of fuels/energy sources as being the major source category contributing to the total mercury releases in the country, it can be noted that males predominate this workforce on offshore oil and gas installations (McKee et al., 2000). Data compiled by the Central Statistical Office of Trinidad and Tobago showed that for 2017, 93% of plant and machine operators were male. It is estimated that waste collectors and workers at waste incineration and landfill facilities are primarily male. Although there was no statistical data for the gender ratio for practicing doctors and dentists in Trinidad and Tobago, it was assumed that the technical assistants and nurses at health care practices are more likely to be female. The gender distributions among environmental/enforcement officers and laboratory workers were found to be relatively equal.

Based on the lack of preliminary information gathered, a more in-depth study of the gender ratios for these professions would be required to accurately confirm and quantify patterns of exposure and at-risk populations, according to gender and occupation type.

4.2.2 Mercury in Cosmetics

The use of skin lightening creams and other cosmetics containing mercury in Trinidad and Tobago has been noted but not quantified. However, 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).

In a study by Mohammed et al (2017), a number of marketed skin-lightening creams in Trinidad and Tobago were tested for mercury, and most samples revealed mercury concentrations exceeding 1 ppm (the allowed concentration under the Minamata



Convention), thus concluding that the creams are not considered “safe” for prolonged human use.

However, the risk of exposure through the use of these mercury-containing cosmetic products is still being determined. The precise rate of dermal absorption of inorganic mercury is influenced by many factors which have made it difficult to assess (WHO, 2014). 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. It is likely that the general public has limited knowledge of the harmful chemicals in these cosmetics, especially as labelling is not regulated in the Caribbean and manufacturers are not required by law to list all the components of their products.

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

The level of awareness on the risks of mercury among identified stakeholders and target populations in a country can vary based on the information provided. Measures should be put in place to educate these groups on the hazards of mercury exposure and the possible action to mitigate the risks. Article 18 in 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 non-governmental organizations 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.

Residents in close proximity to mercury point-sources, such as industries that burn fossil fuels and facilities that handle waste disposal and incineration, should be informed of the added risk of mercury exposure. These targeted groups should be directed on proper safety measures to reduce risks. Similarly, workers at these facilities can be educated on the proper use of personal protective equipment to reduce exposure and measures to reduce the release of mercury to the environment.

It is recommended that medical and environmental professionals in Trinidad and Tobago be trained in assessing and monitoring mercury-related issues in order to better identify the extent of the effects of exposure to communities. This information would also serve to further expound on preventative measures and appropriate treatment options for affected populations. Collaborating with the WHO may aid the Government of Trinidad and Tobago in these efforts.

MAPs add risk of mercury exposure to the population on a whole. Awareness of alternatives to MAPs sold in Trinidad and Tobago can be raised to encourage a safer consumer choice for the citizens. Citizens should be encouraged to support initiatives that would lead to the complete phase-out of MAPs. National action to raise public awareness of mercury hazards should be undertaken in parallel with encouragement for public involvement in reducing environmental and health impacts of mercury contamination. Avenues to facilitate public responsibility should be put in place, such as access to collection, recycling and disposal systems, and incentives for using mercury-free alternatives. Guidelines for separation of contaminated wastes should be created and enforced by municipalities and private waste collectors.

The mercury content in specific brands of skin lightening creams, soaps, batteries and other potentially mercury-containing goods needs to be identified through testing or from existing inventories. Lists of these items should be compiled and distributed to consumers, or made publically accessible to raise awareness of the sources and risks of mercury exposure, and proper methods to safely store, handle, transport and dispose



of mercury wastes. Under the MIA project, a national video and a series of infographics will be developed to highlight the issues posed by mercury in Trinidad and Tobago and the wider Caribbean.

It is also important to inform the public of available, cost-effective mercury-free and mercury-reduced alternatives that could replace the harmful products being used. The department that oversees consumer affairs within the relevant ministry that regulates trading and industry activities would be responsible for disseminating this information.

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.”

The development of an implementation plan is the responsibility of the Government and is optional. The following highlights some of the practical considerations, based on the findings of the inventory, that may be taken should the Government choose to develop an implementation plan.

6.1 Recommendation for Management of Mercury-Added Products (whole life cycle)

Annex A of the Minamata Convention lists the products that a Party must dis-allow from being manufactured, imported and exported by 2020. It also lists the mercury-containing products not regulated by the Convention, and those that are exempt from the 2020 phase-out.

The obligations for the disposal of such mercury-added products are also outlined in Article 11. While some of the mercury in these products can be collected and recycled, Trinidad and Tobago 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 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.

Additionally, while there is a general push to promote the use of mercury-free and mercury-reduced alternatives, public awareness on the hazards of mercury and the benefits of using mercury-free alternatives should be enhanced to encourage a higher

substitution rate. There is also an unfounded perception that mercury-free alternatives do not perform as accurately as their mercury-containing counterparts. Table 32 provides some of the general recommendations for phasing out the key MAPs.

Table 32: Recommended action for phasing out MAPs (adapted from Lennett and Gutierrez, 2016)

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.[26] • 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.[29] • 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, eg. WEEE dismantling plants, to remove batteries from non-hazardous waste streams.

[26] Some of the recognized 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, UN Environment 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



MAP	Recommended Action for Phase-Out
Lighting Devices (CFLs, LFLs, HPMV, CCFLs, EEFLs)[27]	• Promote the use of LEDs and other Hg-free lamp alternatives for general purpose lighting and LCD backlighting.[29] (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 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 World Health Organization 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[29]. • 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 public31 • Develop and enforce proper 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.

[27] 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
	• Provide training and education opportunities for professional dentists and students in dental school on mercury-free dental restoration options and best practices[28] to prevent release of mercury into the environment.

Other recommendations to promote the phase-out of MAPs include the following:

Import regulations

Under Article 4 of the Minamata Convention, Parties will not be permitted to manufacture, import or export certain mercury-added products after the year 2020. To facilitate this transformation, the GoRTT should strengthen the standards with regards to MAPs by beginning to phase-out these products, setting and enforcing maximum allowable mercury content for products that have no available mercury-free alternatives, and ensuring transparent product labelling and training of customs officers to inspect and regulate the import of these products.

The responsible entities in Trinidad and Tobago for the inspection and approval of goods that may contain mercury are the Trinidad and Tobago Bureau of Standards (TTBS), under the Ministry of Trade and Industry and the Chemistry, Food and Drugs Division under the Ministry of Health.

Product labelling

Manufacturers of certain goods are not required by law to list all of the components of their products. As such, numerous imported and local brands of items, including skin lightening creams, cosmetics and electronics are not properly labelled to reflect mercury as an ingredient; do not disclose the toxic properties of the compound; and do not inform users of proper end-of-life management. Since consumers and disposers are unaware of the hazardous nature of these products, they are ignorant of the risks

[28] 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 utilize 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).

associated with handling them, and as such, proper separation and environmentally sound disposal do not take place.

Developing and enacting legislation that enforces transparent labelling of products by their producers are therefore critical steps to aid in the proper collection and disposal of such goods, and to raise public awareness that would lead to the subsequent phase-out of manufactured and imported mercury-added products. Figure 16 is an example of a label that discloses the presence of mercury in fluorescent bulbs and directs users to further information on clean-up procedures and safe disposal.

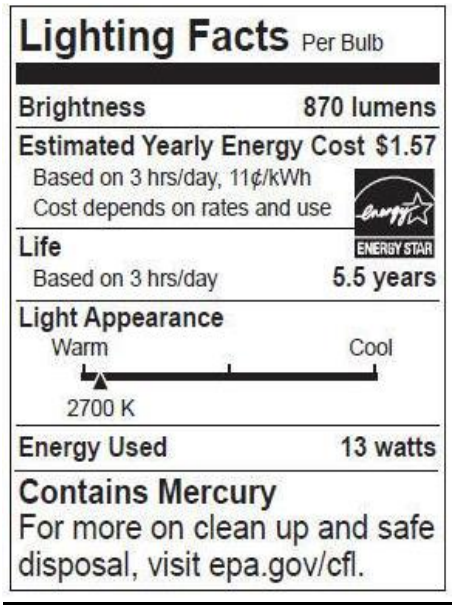


Figure 16: Sample of label for bulbs containing mercury
(Source: US EPA, date unknown)

Inspection and testing

Local government divisions that oversee the inspection and approval of imported and locally manufactured goods can acquire equipment for the inspection and testing of MAPs entering the country as well as being used by the citizenry. These divisions may consider purchasing a Direct Mercury Analyzer (DMA) to test potentially mercury-containing products that are available or will be made available to the public. The *Milestone DMA-80* is an example of equipment that could be used to test up to 40 liquid

or solid samples at a time (Figure 17). Samples do not need to be prepared with additional chemicals as with older mercury analyzers, and mercury concentrations between 0.01-300 ppm can be detected in as little as 120 seconds (Milestone, 2013). The cost of this equipment averages at US $35,000 based on the application and configuration required to achieve the aims of the establishment.

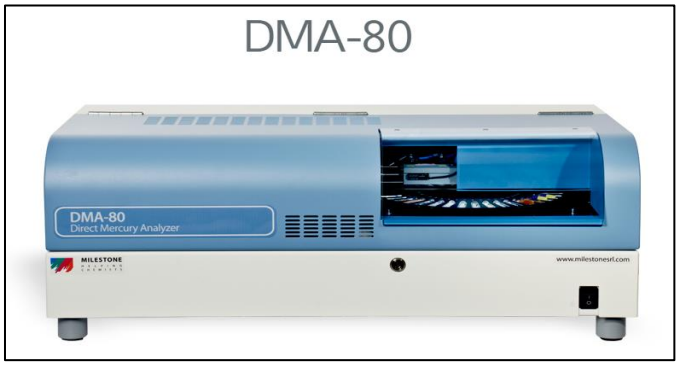


Figure 17: Milestone DMA-80 direct mercury analyzer
(Source: Milestone, 2013)

Identified mercury-containing products should be placed on a restricted list, and Customs workers should be trained to recognize them to aid in preventing them from entering the country. Furthermore, Customs Officers should be trained and equipped with a portable mercury analyser, such as the *Lumex RA-915M Mercury Analyzer*, which would enable them to identify unlisted mercury-added items being collected at the ports, and more importantly, incoming MAPs that are not clearly labelled to show that they contain mercury (Figure 18). The RA-915M can detect mercury in air samples with concentrations as low as 0.5 ng/m^3 or 0.0005 ppm, and will give a real-time rapid analysis of mercury contained in complex objects (Lumex Instruments, 2017). The sensitivity of the RA-915M will aid in the identification of smaller, unidentified mercury-containing components such as batteries and switches in electronic equipment. The Lumex RA-915M mercury analyzer costs approximately US$30,000.

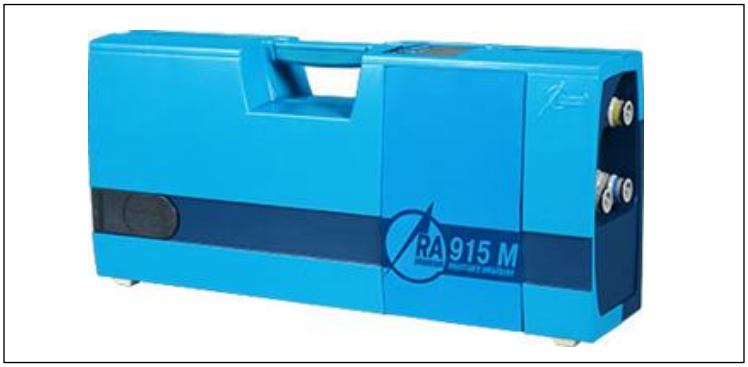


Figure 18: Lumex RA-915M portable mercury analyzer
(Source: Lumex Instruments, 2017)

Extended Producer Responsibility

Measures can be put in place to transfer the responsibility of the end-of-life management of MAPs from municipalities to producers and retailers through take-back collection programmes and extended producer responsibility (EPR). With established take-back programmes, consumers would be able to return mercury-containing wastes to the producers and retailers that sold them the items. These producers and retailers must then ensure the environmentally sound interim storage, transportation and disposal of the collected wastes. The Government should encourage participation by relevant stakeholders, and provide legislation that directs the responsibilities of the involved parties and the methods that would be used for monitoring and enforcement of the programme requirements.

6.2 Recommendations for Management of Mercury Emissions and Releases

Under Article 8 of the Minamata Convention, measures should be undertaken to control and reduce emissions of mercury and mercury compounds (total mercury) to the atmosphere from point sources within the source categories listed in Annex D. In Annex D, the relevant point sources in Trinidad and Tobago refer to:

- Cement clinker production facilities; and

- Waste incineration facilities.

Under Article 9 of the Minamata Convention, Parties shall take measures to control releases to water and land from major point sources and may prepare a national plan to assist in the monitoring of the effectiveness of implementation. Based on the mercury inventory conducted, mercury released due to extraction and use of fuels, more specifically the extraction and refining of natural gas was the most significant source.

Under these Articles, Parties must:

- Implement either one or more of the following measures to "control" releases:
    - Develop mercury release limit values;
    - Use BAT/BEP;
    - Implement a multi-pollutant control strategy; and/or
    - Develop alternative measures to reduce releases.

Parties are also encouraged to regularly update their inventories of mercury emissions and releases.

In Chapter 3 of this report, it was noted that Articles 8 and 9 are covered under the Environmental Management Act and the Air Pollution Rules. Further recommendations that may be considered for point sources of mercury emissions and releases are detailed below:

Extraction and use of fossil fuels

In Trinidad and Tobago, the extraction and processing procedures are done on offshore drilling platforms. Due to the Petroleum Act and environmental legislations such as the CEC Rules, this offshore drilling process is highly regulated and some measures are already in place. Information for the specific procedures used on these drilling platforms could not be obtained but may include the reduction methods given in these recommendations. In many cases, some mercury traces in the raw natural gas are removed in the extraction stage. However, mercury content can be released in the gas cleaning wastewater or condensates and this proved to be the biggest assumed output distribution for this sub-category for Trinidad and Tobago. There are treatment filtration



techniques and mercury removal beds that can be installed to reduce the mercury releases prior to the discharge of the wastewater (UN Environment, 2017a).

During use, when oil and natural gas are combusted, the major release pathway is to air. During the combustion process, air pollution abatement systems can be integrated into the system to reduce the mercury emissions. Particulate matter controls, scrubbers or electrostatic precipitation filters in the exhaust units as well as flue gas controls are efficient in significantly reducing the mercury and would provide great benefits if applied. A key recommendation is to augment these emission control systems by also adding mercury specific filters which can remove a higher percentage of the mercury content in emissions.

Proper waste management techniques for mercury waste residues collected at “end-of-pipe” filtration treatments need to be implemented in order to be consistent with environmentally sound reduction methods. The mercury-containing residues should be safely transported to an interim storage facility or final disposal site and treated as hazardous waste. Regulations would need to be put in place to have periodic testing and monitoring of the emission control technology to ensure that accurate data is collected and that the methods are effective.

Renewable energy technologies, such as the use of wind farms and solar panels, are alternative energy sources that do not contribute to mercury releases and should therefore be considered. There are many factors to be addressed before the successful implementation of such initiatives, such as a cost-benefit analysis. Renewable energy may be a viable long-term financial benefit if integrated into the country’s energy system due to depleting oil and natural gas reserves and the increasing negative health and environmental effects of the extraction, refining and combustion of fossil fuels.

Cement Production

In Trinidad and Tobago, Trinidad Cement Limited (TCL) has already put measures in place to contain dust particles and prevent them from becoming airborne, to effectively clean up and recycle spilled material, and to recover, treat and reuse wastewater. TCL also only uses natural gas to fuel their operations resulting in lower mercury emissions

than if combined with other fuel types. Should other fuel sources be considered for the cement production by TCL in the future, further BAT/BEP measures can be considered to ensure that maximum control and reduction of emissions are continued to be implemented in this sector and the efficiencies of these procedures should be determined through continuous monitoring and evaluation.

Cemeteries and Crematoria

Although it is difficult to remediate existing cemeteries of their mercury contamination, there are procedures to consider for the future reduction of mercury releases in cemetery and cremation practices.

It is recommended that future cemetery site developments should be considered with respect to environmentally sensitive areas. Cemeteries should not be located near waterbodies, vulnerable ecosystems and floodplains. It is also necessary to consider the future placement of crematories as they should not be located in areas that are downwind of densely populated or vulnerable areas.

For crematoria, emission stacks may be monitored for mercury emissions and the funeral homes may consider the introduction of modern mercury filtration systems, carbon injection methods, scrubbers or dust filters into their crematoria chambers; however, this is an expense that many not be feasible. Cultural, social, structural, financial and heritage boundaries of individual funeral homes are to be considered when recommending changes to determine feasibility.

With the use of water monitoring equipment in boreholes in the vicinity of the cemetery tied with the respective cemetery practices, the extent of the mercury contamination can be tested and monitored regularly to determine if mercury contamination is an issue (Jonker and Oliver, 2012).



6.3 Recommendations for Management of Mercury Wastes

Under Article 10 of the Minamata Convention, measures for the environmentally sound interim storage of mercury other than waste mercury are outlined. However, under Article 11 of the Minamata Convention, measures should be taken to ensure the environmentally sound management of wastes that are:

a) Consisting of mercury or mercury compounds;
b) Containing mercury or mercury compounds; or
c) Contaminated with mercury or mercury compounds.

The results of the MIA project in Trinidad and Tobago gave an indicator of the anticipated volumes of mercury and MAPs that would need to be stored and eventually disposed. However, the amount of mercury waste in the inventory showed that it would not prove economically viable to create mercury-specific interim storage facilities in Trinidad and Tobago. An integrated waste management approach, where mercury would be stored with other hazardous waste chemicals, is suggested as a more feasible option. Suggestions for management of mercury wastes are detailed below.

Stabilization, solidification and interim storage of mercury wastes

It is important to create guidelines that ensure that the compatibility of these waste chemicals is taken into account first and that radioactive, infectious or explosive wastes are excluded. Further detailed guidelines for construction, placement and important inclusions for interim storage sites for mercury can be found in the Draft Interim Storage Guidelines outlined at the first Conference of the Parties to the Minamata Convention (UN Environment, 2017b) and the UN Environment 'Practical Sourcebook of Mercury Storage and Disposal' (2013b).

Collection methods and transportation procedures are crucial in the success of an environmentally sound hazardous waste storage facility. The Government of Trinidad and Tobago may dedicate collection centers throughout the nation with easy access to the public or organize mail-in or pick-up services. Vehicles transporting mercury waste need to adhere to specific requirements, such as creating routing plans to ensure the

shortest and fastest routes are used, ensuring the presence of a bulkhead between the driver and the vehicle body, and confirming appropriate safety and emergency equipment are on board. It is essential for mercury waste to be packaged in compatible and sealed containers and not stacked more than 1.5 meters high (Emmanuel, 2010). The requisite authorities will also have to be informed about the transport schedules.

Another recommendation for developing a comprehensive mercury management plan in Trinidad and Tobago is to design and implement a fixed storage, pre-treatment and stabilization/solidification facility for mercury waste before sending it off to a recycling facility or a specially engineered landfill (SEL). It is recommended that this facility be developed and led by the relevant waste management authority in Trinidad and Tobago. The site should include the implementation of measures for the environmentally sound separation of contaminated and non-contaminated materials to reduce the volumes of waste exported for mercury recovery, and the stabilization of mercury-containing wastes for disposal. It is recommended that this facility should also be capable of storing and treating other hazardous chemicals/waste for safe disposal.

Mercury-contaminated wastes being disposed in SELs should be minimized and subsequently eliminated. The fixed storage, pre-treatment and stabilization facility will achieve this by implementing processes, such as chemical oxidation and precipitation, which solidify mercury dissolved in liquid wastes, such as waste sludge from industries, thus facilitating separation and recovery. The facility should also be equipped with chemicals needed to successfully execute stabilization and solidification procedures on mercury-contaminated cosmetics, dental amalgam, sewage sludge, residues and other wastes that cannot be recovered or recycled.

Hydramag, an industrial stabilizing agent based on magnesium oxide, was shown to significantly decrease the volumes of leachable mercury from mercury-contaminated soil in Mongolia (Figure 19). The results of this study showed that using stabilization methods to treat similar wastes before disposal in specially engineered landfills can greatly reduce the leaching potential of mercury and prevent pollution of surface water and groundwater (UNIDO, 2017). Treated material should be temporarily stored until a

SEL is established, or transported to an international disposal site in accordance with Basel Convention requirements.

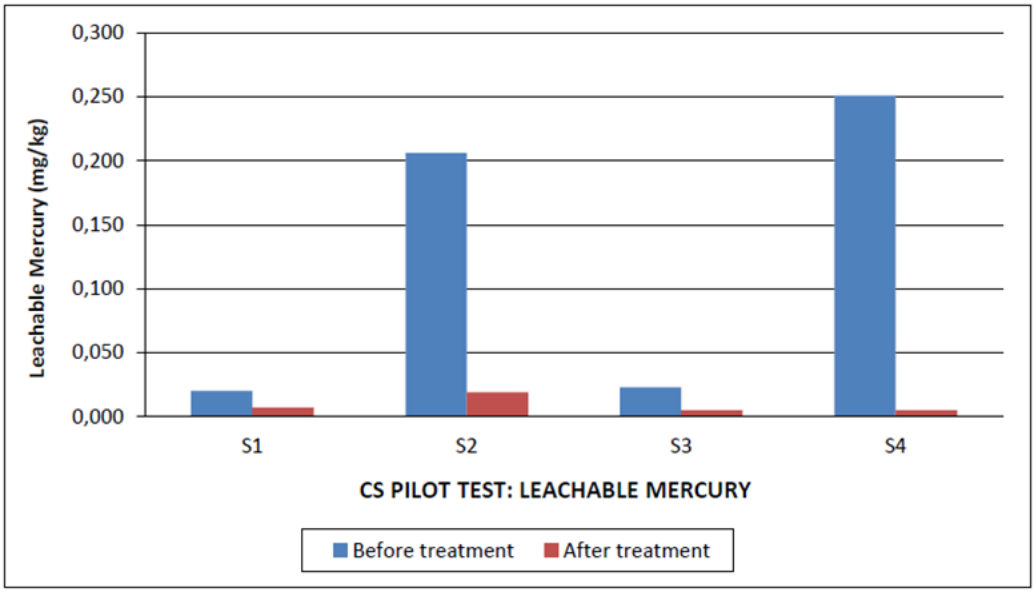


Figure 19: Mongolia chemical stabilization pilot test on mercury-contaminated soils *(Source: UNIDO, 2017)*

Additionally, facility operations should include dismantling of waste electrical and electronic equipment (WEEE) into mercury-containing components, such as switches and relays, batteries, CCFLs and EEFLs, and non-hazardous recyclable components. Section 7.3 of the Basel Convention Partnership for Action on Computing Equipment Guidelines on environmentally sound material recovery and recycling of end-of-life computing equipment has information that could be used to determine the best methods for engaging in e-waste dismantling activities.

To facilitate the safe recycling or disposal of fluorescent tubes (CFLs and LFLs), a bulb recycler system or a bulb crusher should be purchased. The purchased equipment should be able to handle various sizes and shapes of fluorescent bulbs, and should utilize vapor filters to minimize dust and mercury vapor emissions. A bulb recycler system would separate mercury bearing phosphor powder from the other components of fluorescent bulbs (glass and aluminium/plastic) and clean the separated materials which can then be recycled or disposed. CMA Ecocycle in Australia is an example of a facility that successfully manages this approach (CMA Ecocycle, 2015).

A drum-top bulb-crusher or other bulb-crusher mechanically crushes the fluorescent tubes and collects the waste-material in an airtight drum. The bulb crusher does not separate the glass, end caps or mercury bearing phosphor powder, and all collected material, including used filters, will have to be sent to another facility for separation and recycling, or encapsulated in a mercury-immobilizing material before being disposed of in a managed engineered landfill. Crushing the bulbs before shipping for treatment or disposal reduces the volumes needed to be transported, and therefore reduces the associated costs. The Dextrite bulb crusher shown below (Figure 20) costs approximately US $15,000, inclusive of transportation costs.

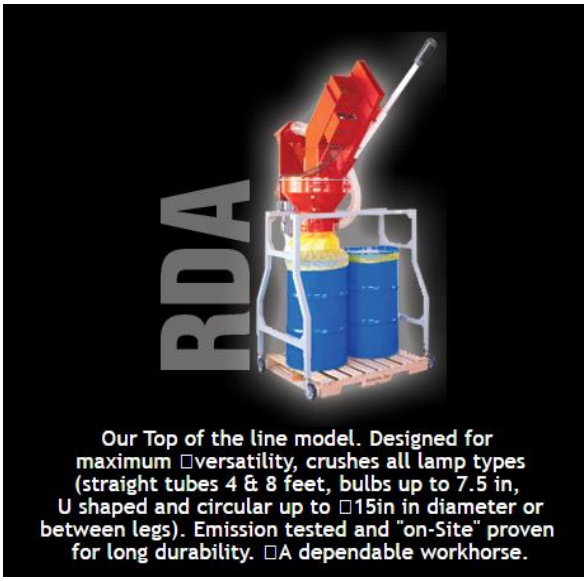


Figure 20: Features of the Dextrite bulb crusher
(Source: Dextrite, 2017)

The Basel Convention ‘Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with mercury or mercury compounds’ (UN Environment/CHW.12/INF/8, 2015) is a useful resource for environmentally sound handling (F1), separation (F2), collection (F3), packaging and labelling (F4), transportation (F5), storage (F6) and disposal (G) of mercury contaminated wastes. The listed measures should be followed when constructing and operating the recommended facility.

All processes should be conducted under reduced pressure to prevent leakage of mercury vapor. Additionally, exhausted air should be directed through a series of particulate filters and a carbon bed to prevent mercury release into the environment. Workers need to receive thorough training on the appropriate and environmentally sound measures of handling purchased equipment and contaminated materials, as well as measures to ensure occupational safety and health. They should also have access to appropriate personal protective equipment (PPE) which they should wear at all times. There needs to be consistent ambient testing done at the site to ensure that emissions are contained and that the concentration of mercury is within the allowable limits.

Waste disposal

Proper waste management methods are essential for the protection of Trinidad and Tobago's health and environment. As detailed in Section 2.8, waste disposal in Trinidad and Tobago is typically done via landfills that have not been specially engineered, but developments are being made to improve upon waste handling procedures.

There are many technical and control procedures that can be included in the environmentally sound management of a landfill such as the separation of municipal, medical and hazardous waste, the use of protective lining under the deposits and the inclusion of a sound wastewater management and treatment system. The development of a SEL is guided under the guidelines under the Basel Convention.

The complete phase-out of mercury waste disposal will not be an immediate action, and measures need to be put in place to ensure that controlled SELs with design features that prevent leaching of hazardous chemicals into the environment are implemented. These features include measures to prevent rainwater and groundwater inflow, to isolate different types of hazardous wastes, to drain, collect, test and treat leachate, and to maintain detailed records on all collected wastes.

Many household consumer products and medical waste products that contain mercury or mercury compounds, such as fluorescent light bulbs, batteries and thermometers end up at landfills mixed in with municipal waste. The predominant recommendation to reduce this mercury content in the landfills will coincide greatly with the recommendations for the nation to switch to the use of mercury-free alternative

products. However, as MAPs are still currently circulating throughout society, these mercury control waste management procedures need to be applied in unison.

To assist in the prevention of mercury releases from the deposition of waste at landfills, the prevention of mercury emissions from the spontaneous combustion, and the intentional burning of municipal and medical waste, a controlled separation system is a significant step for the waste management authorities to undertake. The waste containing mercury can then be transported to an interim storage facility, final treatment or disposal site. At-home measures can also be encouraged for the public to separate out the waste products containing mercury and nation-wide collection points and methods can be put in place. Training waste management personnel, as well as educating the general public on the identification of MAPs is an important inclusion in these separation methods. Other measures to further the mercury management in the waste handling sector include improving the regulations for controlled and uncontrolled landfill requirements, implementing fines on the informal burning of waste, and also creating public awareness campaigns.

Regulated waste incineration facilities also contribute high mercury emissions. If the municipal and medical waste transferred to the incineration facilities did not include mercury-containing waste, emissions would have a much lower mercury concentration and, therefore, separation methods are also extremely beneficial in this aspect. As for the facility itself, control procedures to minimize mercury emissions and contamination can be set in place with regards to site selection, design and construction of future incinerators, as well as operation and monitoring procedures for current incinerators. Flue gas stack controls and dust removal techniques, such as fabric filters can be added to the system to remove mercury from emissions. Depending on the technique chosen, the mercury may be transferred to flue gas or fly ash and therefore subsequently create a new solid or liquid mercury-containing waste stream. This stream then has to be transported and correctly disposed of in a qualified hazardous storage or treatment facility. If resources to invest in these new control technologies are low or unavailable, the modification of operation techniques such as furnace temperature,



reagent type and injection rate can be applied to assist with emission controls until the purchase of equipment can be made.

Periodic monitoring and evaluations are needed to ensure that these control methods are effectively reducing the mercury releases and emissions within the waste deposition and incineration sector. Each landfill and incineration facility can be required to submit periodic reports with required data to keep a track of the measures being implemented. Successful cases can then be shared among the Caribbean region to encourage continued efforts with regard to mercury waste management.

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Annex I: Project Stakeholder List

Name	Job Title	Organization	Address	Contact
Mr. Glen Singh (Ag.)	Comptroller of Customs	Customs and Excise	Ajax Street, Government Plaza, PoS	compt@custom.gov cc: Mrs. Kathy Ann Matthews 612-7010 Ext 5004, 701-6883, dco@custom.gov
Mr. Ronald Roach	CEO	SWMCOL	34 Independence Square, Pos	rroach@swmcol.co.tt cc: mallong@swmcol.co.tt, tadis dillion tdillion@swmcol.com
Dr. Adesh Ramsubhag	Head of Department	UWI – Life Sciences	St Augustine, Trinidad	adesh.ramsubhag@sta.uwi.edu, cc:azad.mohammed@sta.uwi.edu
Ms. Patricia McGaw	Honorary Secretary	COPE	PO Box 1381, 92A Wrightson Rd, PoS	cope2011@gmail.com
Mr Lindford Beckles	Director	Tobago House of Assembly - Department of Naural Resources and the Environment	Tam Building, Glen Road, Tobago	lindfordbeckles@yahoo.com, 639-2273 ext 3617, 485-0459. 328-8095, thadnre@yahoo.com, deon_brebby@hotmail.com
Mr. Keith Belgrove		The Association of Funeral Professional of Trinidad and Tobago	15-17 Toco Road, Sangre Grande	222-3423, 397-1161, kalbelgrove@yahoo.com
Mr. Selwyn Lashley	Permanent Secretary	Ministry of Energy and Energy Industries	Levels 15 & 22-26, Energy Tower, International Waterfront Centre #1 Wrightson Road Port of Spain	slashley@energy.gov.tt
Mr. Glenn Goddard	Lead Advisor	BP Trinidad and Tobago LLC - Area Environmental Operations	5-5A Queen's Park West, PoS	glenn.goddard@uk.bp.com
Mr. Hayden Romano	Managing Director	EMA	8 Elizabeth Street, St Clair	tdaly@ema.co.tt, 628-8042 cc:tbeejai@ema.co.tt

Ms Rehea Jaikaren	HR Manager	Phoenix Park Gas Processors	Rio Grande Drive, Pt Lisas Industries, Point Lisas	rehea.jaikaren@ppgpl.co.tt, 636-1522 ext 222, 687-4631, cc granng@ppgl.co.tt
Ms Katheryn Lucky	Marketing Coordinator	Kaizen	Rajkumar St, Mission Road, Freeport	klucky@kaizen-tt.com, 299-0009, cc: llgajadhar@kaizen-tt.com, 781-2817
Mr. Denis Latiff	General Manager	Tiger Tanks Ltd	Lot 22B Labidco Industrial Estate. La Brea	651-1544, denis.latiff@tigertankstrinidad.com cc anthony.superville@tigertankstrinidad.com, navin.persad@tigertankstrinidad.com
Mr. Mario Amos	Managing Director	Green Engineering	173 Belmont Circular Road, Belmont	624-7336, mamos@greenengineeringtt.com, cc:admin@greenengineeringtt.com greenhazwoper@gmail.com
Ms. Natalie Edghill	Acting HSE Manager	Perenco	8-12 Dere Street, PoS	nedghill@tt.perenco.com, cc: pfifi@tt.perenco.com
		BGTT/Shell Trinidad and Tobago Ltd	5 St. Clair Ave, PoS	636-0040, Ria.lewis@bg-group.com
Dr David Persaud	Environmental Manager	Ministry of Planning and Development – Environmental Planning and Policy Division	Level 7 Tower D, The Waterfront , Port Of Spain	225-3380, david.persaud@planning.gov.tt
Mrs. Toylan Arneaud	Director	IMA	Hilltop Lane, Chaguaramas	director@ima.gov.tt, cc:wnorville@ima.gov.tt
Mr. Richard Madre	Permanent Secretary	Ministry of Health	63 Park St, PoS	hema.maharaj@health.gov.tt, cc:rhonsieu@hotmail.com, hazamthali@gmail.com
Mr. Norris Herbert	Permanent Secretary (Ag)	Ministry of Trade and Industry	Level 17 Ministry of Trade and Industry, Nicholas Tower, PoS	harperlu@gov.tt 623-2931
Ms Lorraine Charles	Manager of Organization Development	Petrotrin	TLC Room 405, Southern Main Road, Point-a-Pierre,	lorrainecharles@petrotrin.com, 658-4200

Professor Valerie Stoute	Vice Provost Post Graduate Studies and Research Programme Professor	UTT - Environmental Studies and School of Post Graduate Studies	Lots 74-98 O'Meara, Industrial Estate, Arima	642-8888 ext 21538, 620-8352, valerie.stoute@utt.edu.tt cc: samantha.chadee@utt.edu.tt
Dr. Lebert Grierson	Head of Department	UWI – Chemistry Department		662-2002 ext 3532, lebert.grierson@sta.uwi.edu, cc: terry.mohammed@sta.uwi.edu
Mrs Angela Siew	Permanent Secretary	Ministry of Agriculture, Land and Fisheries	35 Cipriani boulevard, Newton, PoS	fpps@gov.tt, cc:emohammed.fdtt@gmail.com, lferreira@gov.tt, 622-1221, (fisheries 623-8525)
Mr. Ramesh Ramdeen	CEO	TTMA	42 10th Avenue, Barataria	ceo@ttma.com, info@ttma.com, 675,8862
Dr Asha Lal	Secretariat	Dental Council of TT	11-13 Fitzblackman Drive, Wrightson Rd, PoS	dctt@dctt.org.tt, 625-7627
Dr Christina Lee		Dental Association		infottda@gmail.com
Ms Gloria Jacobs	Planning and Development Manager	TCL	Trinidad Cement Limited, Southern Main Road, Claxton Bay.	gloriaj@tcl.co.tt, 384-6356cc: hannahw@tclgroup.com, 800-4825
Mr. Gabriel Faria	CEO	TTCIC	Columbus Circle, West Moorings, P.O. Box 499, PoS, Trinidad, WI	gfaria@chamber.org.tt, cc: rnelson@chamber.org.tt, 637-6966
Mr. David Ramkissoon	CEO	Electrical Industries Ltd	1 Century Drive, Trincity Industrial Estate, Macoya, Tunapuna	wendy.reyes@electricalindustriesgroup.com, 223-1294
Mr. Maurice Suite	Permanent Secretary	Ministry of Public Utilities	1 Alexandra St, St Clair, PoS, Trinidad	suitem@gov.tt, cc: vjitman@mpu.gov.tt, 628-9500
Ms. Jenna Ross	Administrative Manager	Oil Mop Enviromental Services Ltd	13 Labidco Industrial Estate, La Brea Trinidad.	jennaross@oilmoptt.com, 651-1306
Mr. Brian Allum	Managing Director	Piranha International Ltd	10-11 Bahadoor Street, Southern Main Road, California	brian.allum@piranhatt.com
Mr Sherland	Director of	WASA	WASA Head Office, St	shep2475@wasa.gov.tt

Shephard	Operations		Jospeh	
Mr Kelvin Ramsook	General Manager	T&TEC	63 Federick St, PoS	cbrown@ttec.co.tt, 623-2611 cc: dstclair@ttec.co.tt, msmodeste@ttec.co.tt
Catherine or Karen		Campbell's Dental	77 Henry St, PoS	campbellsdental@yahoo.com
Ms Dhanwattee Ramdath	Permanent Secretary	Ministry of Works and Transport	Level 6 corner Richmond and London St, PoS	dramdath@mowt.gov.tt, 625-1225
Mr Henley Harewood	VP Health, Safety, Security and Environment	ALNG	Lot #1, 1A and 1, Corner Clifton Crescent and Hilltop Avenue, Clifton Hill, Point Fortin	henleyharewood@atlanticlng.com cc: NElias-Samlalsingh@atlanticlng.com
Ms Andrea Julien		Ministry of Planning and Development - Senior State Counsel, Legal Services Unit		
Mr Theodore Reddock	Director	TTBS	1-2 Century Drive,Trincity Industrial Estate, Macoya	theodorereddock@ttbs.org.tt
Ms Sophia Gadjadhar	TGC dental and medical Supply			tgc@yahoo.com, attention sophia gadjadhar

Annex II: Stakeholder Questionnaires

Questionnaire for <u>Oil and Gas Sector</u>
Minamata Initial Assessment Project

COMPANY NAME	
MAILING ADDRESS	
CEO/VICE PRESIDENT/DIRECTOR	
COMPANY CONTACT	Full Name:
	Official Position:
	Telephone No.: Fax No.: Mobile No.: Email:
SIGNATURE	
DATE (DD/MM/YYYY)	

1. Facility Category:

   ☐ Petroleum
   ☐ Natural Gas Production, Compression, Blending or Liquifaction Facility
   ☐ Other (*please specify*)_____

   _____

2. Provide a brief description of the facility's operations and activities that generate or *are expected* to generate mercury, mercury-containing or mercury-contaminated waste.

Process	Raw Materials	Products & By-products	Wastes and Emissions	Frequency of Production

3. For the past five (5) years, kindly indicate the following information where applicable:

	Oil Extraction	Oil Refining	Extraction and Processing of Natural Gas
Years	**Crude Oil produced (t/y)**	**Oil refined (t/y)**	**Produced gas (Nm^3/y)**
2012			
2013			
2014			
2015			
2016			

4. Please provide any information on potential mercury, mercury-containing or mercury-contaminated waste/effluent/wastewater/liquids/materials generated through your process/es and company facilities.

	Industry Segment	Category	Amount Discharged (including what is stored and what is disposed of) (Please state appropriate units)
Water	Natural Gas Production, Compression,blending or liquifaction facility	Produced Water	
	Oil Refining	Refinery WasteWater	

	Oil Transport	Tanker Ballast Wastewater	
Solid Waste	Oil and Gas Exploration	Drilling Waste	
	Oil Refining	Refinery Waste	
Air	Natural Gas Production, Compression, blending or liquifaction facility	Spent catalyst, carbon beds, Absorbent material, other	
	Oil and Gas Production, Compression, Compression, blending or liquifaction facility	Flared Gas/Stack Emissions	
	Oil Production	Fugitive Emissions	
	Natural Gas Production, Compression,blending or liquifaction facility and Transmission	Fugitive Emissions	
	Oil Production	Fuel Combustion	
	Natural Gas Production, Compression, ,blending or liquifaction facility	Fuel Combustion	
OTHER Examples: Mercury Containing or Contaminated Material, Condensate, bulbs and light fixtures, etc.			
CATALYST (if used in your process please identify the type of catalyst			

material)	

5. **Mercury Management Programme**

Is there any mercury management program or are there any measured in place currently to reduce, manage or prevent the use of Mercury and/or to prevent Mercury from entering into the atmospheres, land, water or disposal of Mercury, Mercury containing and Mercury contaminated waste?

_____

_____

_____

6. **Confidentiality Claim**

If any information provided is considered to be a trade secret, confidential business information and/or if disclosed, would be contrary to the public interest; please indicate below:

Yes ☐

No ☐

Please explain:_____

_____

_____

Please submit this data within three (3) weeks of receipt of this correspondence.

Thank you for taking the time to complete this survey

Questionnaire for Power Generation Sector
Minamata Initial Assessment Project

COMPANY NAME	
MAILING ADDRESS	
CEO/VICE PRESIDENT/DIRECTOR	
COMPANY CONTACT	Full Name:
	Official Position:
	Telephone No.: Fax No.: Mobile No.: Email:
SIGNATURE	
DATE (DD/MM/YYYY)	

1. For the past five (5) years, kindly indicate the following information where applicable:

Years	Natural Gas Processed (Nm^3/y)
2012	
2013	
2014	
2015	
2016	

2. What is the MW rating for the plant?

_____

3. How much electricity (MW) do you produce annually? At Peak?

4. Is the purchased natural gas treated to remove mercury? If yes what is the purchase specification for mercury content in purchased natural gas?

5. Is there any mercury air emission monitoring systems operating at your plant? If so describe their operation and results.

6. Describe the company's mercury management program to reduce mercury waste generation, manage the disposal of mercury wastes and actions to prevent mercury from entering into the atmospheres, land, and water.

Please submit this data within three (3) weeks of receipt of this correspondence.

Thank you for taking the time to complete this survey.

Questionnaire for Cement Production
Minamata Initial Assessment Project

NAME			
COMPANY NAME			
ADDRESS			
CONTACT INFORMATION	PHONE:	MOBILE:	EMAIL:

1. **For the past five (5) years, kindly indicate the following information if available:**

Years	Cement Production (tonnes of cement produced, t/y)
2012	
2013	
2014	
2015	
2016	

2. **What type of fuel do you use at your facility for processing cement?**

_____

3. **Do you have co-incineration of waste? If yes, please indicate the types of waste incinerated and the average volume incinerated per year.**

_____

_____

_____

4. **What type of emission controls (e.g. scrubbers) do you use in your processing facility?**

_____

_____

5. **Have any of your emission controls indicated the presence of mercury? If yes, please detail the disposal process used.**

_____

_____

_____

<u>Please submit this data within two (2) weeks of receipt of this correspondence.</u>

Thank you for taking the time to complete this survey.

Questionnaire for Customs Division
Minamata Initial Assessment Project

MERCURY AND MERCURY CONTAINING DEVICES

NAME			
COMPANY NAME (IF APPLICABLE)			
ADDRESS			
CONTACT INFORMATION	PHONE	MOBILE	EMAIL

Please fill in the table below with the required details on the categories of measuring devices imported in 2015 and 2016, where applicable:

	Item	Relevant HS Codes	Country of Origin, if available	g Hg/item, if available	Units imported in 2015	Units imported in 2016
1	Mercury in flasks of a net content of 34,5 kg "standard weight", of a fob value per flask of <= € 224	2805 40 10				
2	Mercury (excl. in flasks of a net content of 34,5 kg "standard weight", of a fob value per flask of <= € 224)	2805 40 90				
3	Amalgams of precious metals	2843 90 10				
4	Compounds, inorganic or organic, of mercury (excl. amalgams)	2852 00 00				
5	Inorganic compounds, n.e.s.; amalgams (excl. of precious metals)	2853 00 90				

6	Clinical thermometer containing mercury	9025 1120				
7	Clinical thermometer mercury free	9025 1920				
8	Ambient air thermometer containing mercury	9025 1180				
9	Ambient air thermometer mercury free	9025 1920				
10	Industrial and special application thermometers containing mercury	9025 1180				
11	Glass thermometers with Hg for laboratories	9025 1180				
12	Glass thermometers Hg free for laboratories	9025 1920				
13	Barometers/manometers containing mercury	9025 8020				
14	Barometers/manometers mercury free	9025 8020				
15	Hydrometers, pyrometers, hygrometers, etc., containing mercury and combinations excl. 9025 1120 and 9025 1180	9025 8080				
16	Hydrometers, pyrometers, hygrometers, etc., mercury free and combinations excl. 9025 1920	9025 8040				
17	Instrument/apparatus to measure or check the pressure of liquids/gases mercury free	9026 2000				
18	Instrument/apparatus to measure or check the pressure of liquids/gases containing mercury	9026 2000				
19	Spectrometers, spectrophotometers and spectrographs using optical radiations, such as UV, visible, IR	9027 30 00				

20	Instruments and apparatus for physical or chemical analysis, using UV, visible or IR optical radiations (exlc. spectrometers, spectrophotometers, spectrographs and gas or smoke analysis apparatus)	9027 50 00				
21	Sphygmomanometers mercury free (medical blood pressure gauges)	9025 8020				
22	Sphygmomanometers containing mercury (medical blood pressure gauges)	9025 8020				
23	Thermostats mercury free	9032 1000				
24	Thermostats containing mercury	9032 1000				
25	Discharge lamps, fluorescent, hot cathode with double ended cap	8539 3110				
26	Discharge lamps, fluorescent, hot cathode excluding with double ended cap	8539 3190				
27	Mercury or sodium vapour lamps; metal halide lamps	8539 3200				
28	Low energy consumption lamps	8539 3910				
29	Discharge lamps, other than ultra-violet, low energy and fluorescent lamps	8539 3990				
30	Ultra-violet or infra-red lamps excl. arc lamps	8539 4900				
31	Manganese dioxide primary cells or batteries	8506 1000				
32	Mercuric oxide primary cells or batteries	8506 3000				
33	Silver oxide primary cells or batteries	8506 4000				
34	Lithium primary cells or batteries	8506 5000				
35	Air-zinc primary cells or batteries	8506 6000				
36	Other primary cells/batteries	8506 8000				
37	Laptops	847 130				
38	Cell Phones	851 712				



39	LCD Screens	8528 5900				
40	LC Screens	8528 7390				
41	Cosmetics containing mercury					
42	Paint containing mercury					
43	Pesticides and biocides containing mercury					
44	Pharmaceuticals containing mercury					

Please submit this data within two (2) weeks of receipt of this correspondence.

Thank you for taking the time to complete this survey.

Questionnaire for Mercury Containing Devices
Minamata Initial Assessment Project

NAME			
COMPANY NAME (IF APPLICABLE)			
ADDRESS			
CONTACT INFORMATION	PHONE	MOBILE	EMAIL

1. Kindly fill in the table below with information for the most recent year, if applicable:

	Do You Import/Use These Items?	**Yes/No**	**Quantity /Year**	**Purchasing Institution (i.e. who purchases this from you)**	**Comments (Is it still imported, replacement devices on market?)**
1	Mercury Lab Thermometer				
2	Mercury Fever Thermometer				
3	Mercury Cooking Thermometer				
4	Mercury Sphygmomanometer				
5	Mercury Barometer				
6	Mercury Hygrometer				
7	Mercury Hydrometer				

8	Mercury Vacuum Gauge				
9	Mercury Spectral Tube				
10	Mercury Sling Psychrometer				
11	Mercury Gas Law Apparatus				
12	Mercury Anemometer				
13	Other metallic mercury containing instruments (Please list as needed)				

2. If applicable, please indicate how are the items indicated in the above table disposed of after use/breakage?
   - □ General Waste Disposal
   - □ Private Waste Company Disposal (please specify the company)_____
   - □ Other_____

Kindly fill in the table below with available information for the most recent year, if applicable:

	Do You Import/Use These Items?	**Yes/No**	**Quantity /Year**	**Purchasing Institution (i.e. who purchases this from you)**	**Comments (Is it still imported, replacement devices on market?)**
1	Fluorescent Tubes (double ended)				
2	Compact Fluorescent lamp (CFL singled ended)				
3	High pressure mercury vapour lights				
4	High pressure discharge lamps				
5	High pressure sodium lamps				
6	UV light (for tanning)				

7	Metal halide lamps				

1. If applicable, please indicate how are the items indicated in the above table disposed of after use/breakage?

   □ General Waste Disposal

   □ Private Waste Company Disposal (please specify the company)_____

   □ Other_____

Please submit this data within two (2) weeks of receipt of this correspondence.

Thank you for taking the time to complete this survey.

Questionnaire for Dental Sector
Minamata Initial Assessment Project

NAME			
COMPANY NAME (IF APPLICABLE)			
ADDRESS			
CONTACT INFORMATION	PHONE:	MOBILE:	EMAIL:

1. **Which do you use in your dental practice?**

- ☐ Elemental mercury (from a dispenser)
- ☐ Pre-capsulated mercury
- ☐ None

2. **Can you indicate the dental amalgam supplier to your dental practice?**

_____

3. **For the past year (1), kindly indicate the following information where applicable:**

Years	Number of Old Amalgams Removed	Number of New Amalgams Placed
2016		

4. **What type of chair side trap filter do you use?**

- ☐ Reusable
- ☐ Disposable

5. **How do you manage your waste from chair side traps? (please tick all that are applicable)**

- ☐ Recycle
- ☐ General garbage
- ☐ Biohazard Waste
- ☐ Wash down sink
- ☐ Don't know
- ☐ Other (please explain)_____

Questionnaire for Waste Incineration
Minamata Initial Assessment Project

NAME			
COMPANY NAME			
ADDRESS			
CONTACT INFORMATION	PHONE	MOBILE	EMAIL

Years	Incineration of Municipal/ General Waste *Waste incinerated (t/y)*	Incineration of hazardous waste *Waste incinerated (t/y)*	Incineration of medical waste *Waste incinerated (t/y)*	Sewage Sludge Incineration *Waste incinerated (t/y)*	Open fire waste burning (on landfills and informally) *Waste burned (t/y)*
2012					
2013					
2014					
2015					
2016					

- Do any of the incinerators have air emissions controls present? If yes, please indicate the type.

_____

Thank you for taking the time to complete this survey.

Questionnaire for <u>Wastewater Treatment</u>
Minamata Initial Assessment Project

NAME			
COMPANY NAME			
ADDRESS			
CONTACT INFORMATION	PHONE	MOBILE	EMAIL

1. Kindly indicate the following information, where applicable:

Year	Estimated Percentage of wastewater that derived from General/Municipal Sources (%)	Estimated Percentage of wastewater that derived from Industrial Sources (%)	Wastewater Treated (m^3/year)	Amount of Sewage Sludge Produced (*if applicable*) (kg/year)
2012				
2013				
2014				
2015				
2016				

2. What type of wastewater treatment is used?

☐ No treatment; direct release from sewage pipe

☐ Mechanical treatment only

☐ Mechanical and biological (activated sludge) treatment; no land application of sludge

☐ Mechanical and biological (activated sludge) treatment; 40% of sludge used for land application

☐ Other (please specify) _____

3. Please indicate if mercury was ever used/ is still in use in wastewater treatment operations at your facility, and if so, how was/is it used?

_____

_____

Thank you for taking the time to complete this survey.

Questionnaire for Funeral Homes
Minamata Initial Assessment Project

NAME			
COMPANY NAME			
ADDRESS			
CONTACT INFORMATION	PHONE:	MOBILE:	EMAIL:

1. For the past five (5) years, kindly indicate the following information:

Years	Number of Burials/Year	Number of Cremations/Year
2012		
2013		
2014		
2015		
2016		

2. If applicable, do your cremation chambers have scrubbers or any other filter equipment? If yes, please indicate how the residue is disposed of.

   .....

   .....

3. Do your services include open burning/ pyre cremations? If yes, please indicate an average number of how many of these types of cremation take place per year.

   .....

   .....

Please submit this data within one (1) week of receipt of this correspondence.

Thank you for taking the time to complete this survey.

Annex III: Inventory Spreadsheet

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

http://www.bcrc-caribbean.org/what-we-do/minamata-convention-on-mercury/trinidad-and-tobago-inventory-of-mercury-releases-2018/

If any issues arise in accessing link, please contact the BCRC-Caribbean via e-mail at: info@bcrc-caribbean.org