BASEL CONVENTION

MINAMATA CONVENTION ON MERCURY

UNEP

MERCURY RELEASE INVENTORY, WASTE STORAGE AND DISPOSAL IN TRINIDAD AND TOBAGO

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LIST OF ABBREVIATIONS

AMAP	Arctic Monitoring and Assessment Programme
bbls	Barrels of oil
BCRC-Caribbean	Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean
CECs	Certificates of Environmental Clearance
CH_3Hg	Methylmercury
CME	Chicago Mercantile Exchange
GDP	Gross Domestic Product
GoRTT	Government of the Republic of Trinidad and Tobago
Hg	Mercury
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
ISWA	International Solid Waste Association
km	kilometre
l	Litre
LNG	Liquefied Natural Gas
MEEI	Ministry of Energy and Energy Industries
mcf	million cubic feet
mg/kg	milligrams per kilogram
Nm^3	normal cubic metres
ODA	Official Development Assistance
PETROTRIN	Petroleum Company of Trinidad and Tobago
PPGPL	Phoenix Park Gas Processors Limited
ppm	parts per million
PVC	Polyvinyl chloride
SEL	Specially Engineered Landfill
SIDS	Small Island Developing States
sq	squared
SWMCOL	Trinidad and Tobago Solid Waste Management Company
TCL	Trinidad Cement Limited
TGU	Trinidad Generation Unlimited
µg/g	micrograms per gram
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP DTIE	United Nations Development Programme Division of Technology, Industry and Economics
UNITAR	United Nations Institute for Training and Research
USGS	United States Geological Service
VCM	Vinyl chloride monomer
WHO	World Health Organisation
y	year

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EXECUTIVE SUMMARY

Mercury is considered by the World Health Organization (WHO), as one of the top ten chemicals or groups of chemicals of major public health concern. This is primarily because all forms of mercury have been established as toxic to both humans and animals; with no biological benefits and causing deleterious health impacts. It also results in serious contamination to the natural environment. The chemical is used in a range of areas including the industrial, commercial, health, domestic and waste sectors.

The Minamata Convention on Mercury was formally adopted on October 10th, 2013 as a global response to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The Convention embodies both voluntary and compulsory measures that aim to reduce the impact of mercury on health and the environment, through various provisions related to extraction, usage, releases, trade, storage and waste management.

The Republic of Trinidad and Tobago is a twin island state in the Caribbean region with an average population of 1.3 million. The country has the highest Gross Domestic Product (GDP) in the region primarily due to its rich natural resources in oil and gas, which has allowed for downstream industrial development. The country is the world's largest exporter of ammonia and the second largest of methanol (Ministry of Energy and Energy Industries, 2016). Despite the presence of several potential sources of mercury in the country, Trinidad and Tobago is still yet to become a signatory of the Minamata Convention on Mercury.

The Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region (BCRC-Caribbean), in collaboration with the UNEP "Chemicals and Waste Branch" of the United Nations Environment Programme Division of Technology, Industry and Economics (UNEP DTIE), received funding from the Norway Official Development Assistance (ODA) for execution of the "Mercury Storage and Disposal Project in the Caribbean: Jamaica, Trinidad and Tobago, Suriname." The Project aims to increase the capacities for environmentally sound storage and disposal of mercury in the participating countries and thereby assist participating countries with acceding, ratifying and implementing the Minamata Convention.

One way to advance this process, is to provide evidence of the potential sources of mercury and mercury pollution through the development of a national inventory of Mercury Releases in Trinidad and Tobago. As such, relevant stakeholders participated in the development of the inventory which was developed in 2016 based on data from 2015. This inventory was designed using the United Nations Environment Programme's (UNEP) Toolkit for Identification and Quantification of Mercury Releases (Inventory Level 1). The Toolkit is based on mass balances for each mercury release source type group. The Inventory Level 1 works with pre-determined

factors used in the calculation of mercury inputs to society and releases, the so-called default input factors and default output distribution factors.

The inventory found that the major sources of mercury, in terms of estimated total releases, in the Republic of Trinidad and Tobago are:

- Use and disposal of other products (**309 kg Hg/y**)
- Oil and gas production (**170 kg Hg/y**)
- Other materials production (cement production) **(109 kg Hg/y)**[1]*****

It should be noted that the toolkit Level 1 inventory was a desktop study that was completed using information gathered from questionnaires dispersed to relevant stakeholders, as well as from statistical websites. The questionnaires used are attached at Annex I. The data entered into the Toolkit was based on activity rates which generated the data values for each sector. For a more detailed estimation of mercury releases, it is recommended that a Level 2 inventory be completed.

The project also examined two additional components:

- Legislative and Policy Review and
- Storage and Disposal Options

In Trinidad and Tobago, the legislative and policy review indicated that several pieces of legislation need to be amended in order to cover mercury. These are:

- Pesticides and Toxic Chemicals Act and Regulations Chap. 30:03 which include:
    - Toxic Chemicals Regulations, 2007
- The Environmental Management Act Chap. 35:05, which include:
    - Certificate of Environmental Clearance Rules, 2001 and its Order, Certificate of Environmental Clearance CEC (Designated Activities) Order 2001 (as amended 2007, 2008
    - Water Pollution Rules 2001 (as amended 2006)

[1] * **NOTE: Estimation for total Hg releases for cement production based on assumptions in UNEP Toolkit for Identification and Quantification of Mercury Releases (Inventory Level 1). See SECTION 4.1 of this report for clarifications.**

    - Air Pollution Rules, 2014
    - Draft Waste Management (Hazardous Waste) Rules, 2014
- The Occupational Safety and Health Act Chap. 88:08
- Customs Act, Chap. 78:01
- Food and Drugs Act, Chap. 30:01

As it relates to storage and disposal, three (3) main options were detailed:

1) To develop a facility (or facilities) for interim storage of mercury waste, the location of which will need to be determined in further discussions with relevant stakeholders. A consolidation of mercury waste produced by individual companies would be done by the companies themselves who would have to develop infrastructure "in-house" to arrange for the environmentally sound collection and transport of the waste to the interim storage facility. The interim storage sites would be developed in collaboration with the main waste management companies as a sanitary engineered landfill under an integrated waste management approach, meaning that mercury waste as well as other hazardous waste will be handled at the facility.

2) To have stabilisation/ solidification processes done at the interim storage facilities for the mercury waste. The recommended process would be solidification via cementation where the mercury waste would be encased in a solid block.

3) To export the waste at a national level for environmentally sound disposal to a processing facility where environmentally sound mechanisms exist for the proper extraction and disposal of mercury, for example in countries like the United States of America, Canada, Spain and the Netherlands. The exportation of solidified waste may be expensive due to the potentially large mass of the solid blocks so considerations would need to be made as to how these costs could be off-set.

With respect to cement production, it is recommended that a follow-up is done to account for the type of fuel, cleaning methods and raw materials used in the process on a national level as these factors may account for the sector having much lower mercury emissions.

Based on the low response rate to questionnaires disseminated for data collection in this inventory, a follow-up survey with stakeholders is recommended.

It is recommended that the Government of the Republic of Trinidad and Tobago accede to the Minamata Convention on Mercury in order to better facilitate the implementation of environmentally sound management of mercury waste in the country. However, it should be

noted that the time dedicated to obtaining the data for this project was approximately three (3) months resulting in an inventory that was incomplete. As a direct result, Trinidad and Tobago cannot commit to any policy directives at this time. Additionally, this high level of decision making must be approved under the auspices of Cabinet.

Fortuitously, Trinidad and Tobago is part of the more detailed Minamata Initial Assessment Project which will utilise the Inventory Level 2 and be conducted over a two (2) year period. It is anticipated that an informed decision can then be made once a thorough inventory is complete.

1.0 INTRODUCTION

1.1 BACKGROUND

Mercury is a naturally occurring element in the Earth's crust that can have various organic and inorganic forms. An atomic number of 80 makes it a heavy metal and is the only metal that is a liquid at room temperature. Mercury is considered a highly toxic metallic element. It is released from both natural and anthropogenic sources. Anthropogenic sources account for 30% of the mercury emissions in the atmosphere (UNEP 2013). Mercury can neither be broken down nor destroyed so once it has entered the environment, it persists. Only the form in which it exists may change. Mercury cycles between air, land and water and may eventually be removed naturally from the system through burial in deep ocean sediments or through entrapment in stable mineral compounds. The various sources of mercury (detailed in Section 1.2) and the transport and mobilization processes are complex and they come together to create a biogeochemical cycle appropriately titled the 'Global Mercury Cycle' (UNEP 2013). This is shown below in Figure 1.

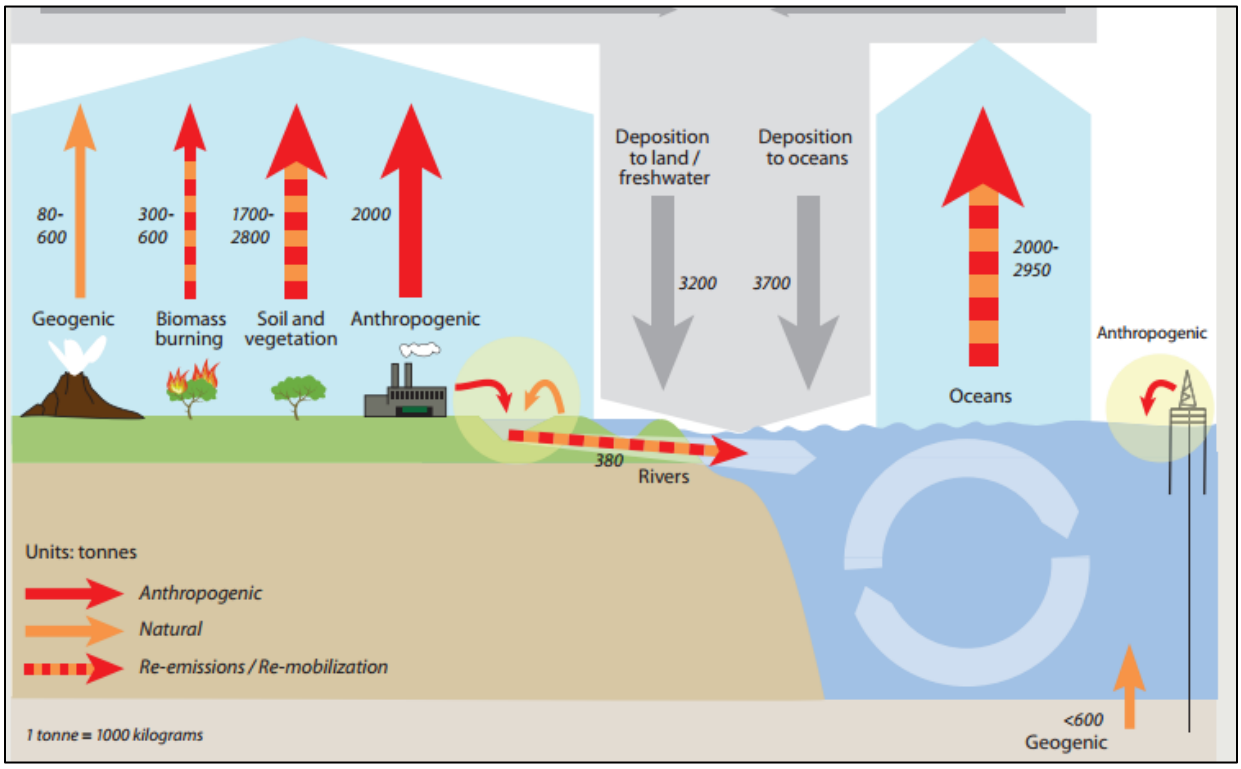

Figure 1: The Global Mercury Cycle (UNEP 2013) [*Values in tonnes of mercury]

According to the United States Geological Service (USGS) (2009), the potential for high toxicity of mercury depends on the form present. The most toxic form of mercury is methylmercury [CH_3Hg] and this occurs when microbes present in aquatic ecosystems interact with inorganic mercury. Methylmercury is found in lakes, rivers, sediments, wetlands and in the ocean. It is a very strong neurotoxin that is extremely hazardous, as in this organometallic state, mercury can be biomagnified and transferred up the food chain (Ullrich et al 2010), resulting in adverse health effects on top predators, especially humans. Bioaccumulation in humans allows the methylmercury to easily penetrate the blood-brain barrier and affect the central nervous system. This is a particular threat to the development of foetuses and juveniles (Diez 2009). Various parts of the body are also affected by mercury, including but not limited to eyes, skin, gums, the central nervous system and the thyroid. The serious health effects caused by mercury emphasise the need for the monitoring of sources of mercury entry into the environment (UNITAR 2016).

One of the most notable cases of methylmercury poisoning occurred in Minamata, Japan during the 1950s (Harada, 1995). Persons living in Minamata ingested seafood that was contaminated by methylmercury. The Minamata Bay pollution was a direct result of the disposal of contaminated industrial wastewaters from the production of acetaldehyde which utilised a mercury catalyst. The mercury from the wastewater was absorbed by the aquatic organisms, including fish and shellfish from the Bay. After several years, the contaminant bioaccumulated in the food chain and many of the people who ingested the fish and shellfish from the bay became ill. In 1956, doctors in the area reported that there was an epidemic of an unknown disease of the central nervous system; this was deemed as the official discovery of the Minamata disease. The marine organisms from the Bay were tested and mercury levels ranged from 5.61 ppm to 35.7 ppm. These high traces led to many abnormalities in health and the patients who were taken for medical care all experienced sensory disturbances, a loss of peripheral vision, ataxia, and numbness (Harada 1995). Effects were persistent and could still be seen within the population for many years after.

This large-scale public health crisis drew attention to the issue of mercury in the environment, especially as a result of human activities and led to various international agreements. More recently, in 2001, the Governing Council of the United Nations Environment Programme invited its Executive Director to undertake a global assessment of mercury and its compounds. Following that, after various decisions were made, in January 2013, at the fifth (5^{th}) session of the intergovernmental negotiating committee, the text of the Minamata Convention on Mercury was agreed to (UNEP, 2016). The objective of the Convention is to protect the human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds (UNEP, 2016).

1.2 SOURCES OF MERCURY

According to the Global Mercury Assessment (UNEP, 2013), the major sources of mercury worldwide are:

- Artisanal and small scale gold mining;
- Coal combustion;
- Non-ferrous metals;
- Cement production;
- Consumer products;
- Iron and Steel production;
- Chlor-alkali production;
- Oil refining

The Global Mercury Assessment 2013 found Asia to be the largest contributor of mercury into the environment, accounting for almost 50% of global emissions. The Latin America and Caribbean region accounted for 2.4% which was approximately 47.2 tonnes per year of mercury emissions and this was primarily due to chlor-alkali production (UNEP, 2013).

Figure 2 below provided in the Arctic Monitoring and Assessment Programme (AMAP)/ UNEP technical background report for the Global Mercury Assessment 2013, showed that artisanal and small scale gold mining produces the highest emissions.

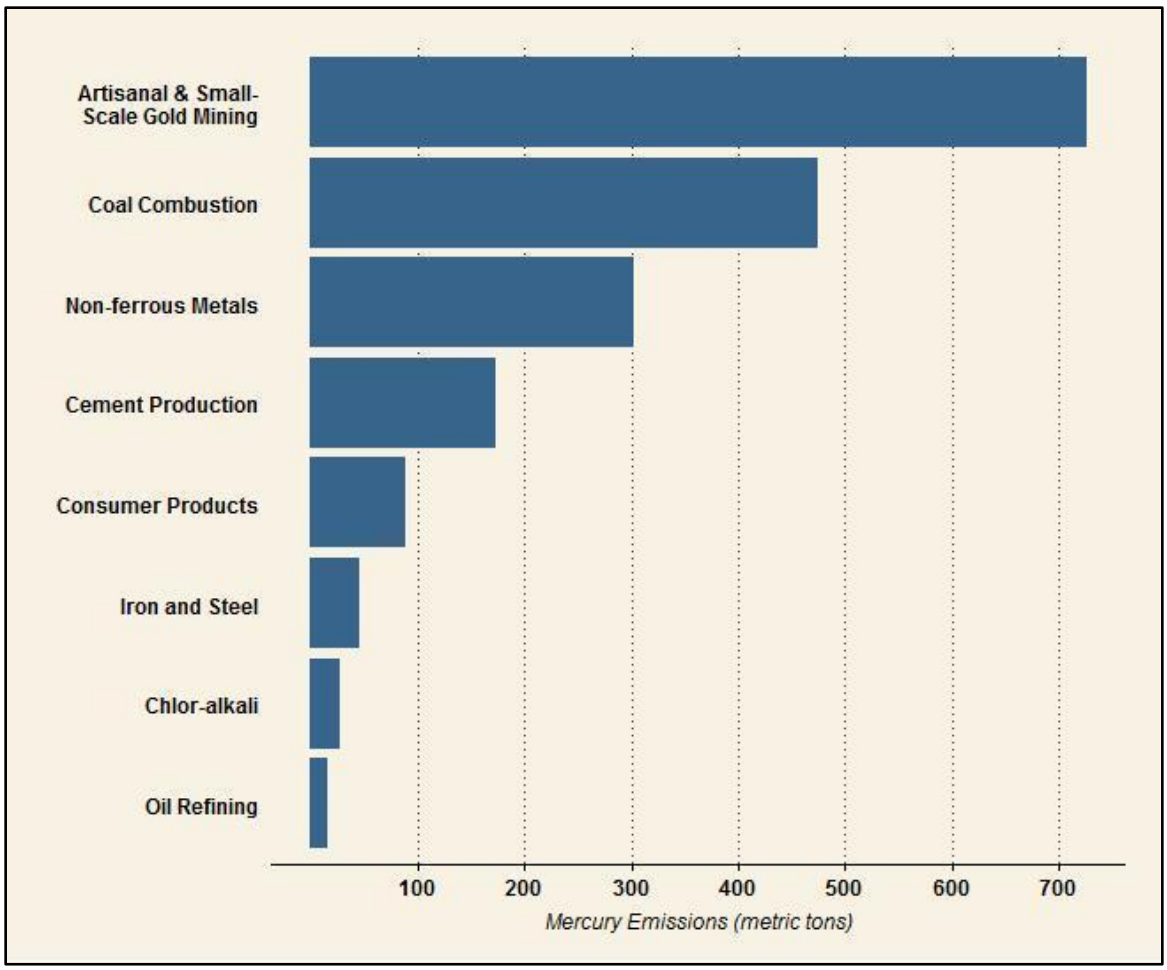

Figure 2: Major Sources of Mercury Emissions to the Environment (AMAP, 2013)

1.3 COUNTRY INFORMATION

1.3.1 Physical Description

The Republic of Trinidad and Tobago is an archipelagic twin-island state located at the southern end of the Caribbean island chain (Figures 3 and 4). The country is positioned in both the northern and western hemispheres at 10° 2’ and 11° 12’ N latitude and 60° 30’ and 61° 56’ W longitude close to the South American mainland as shown in Figure 3.

Trinidad and Tobago is a small island developing state (SIDS), with Trinidad approximating an area of just 4,828 sq km; while Tobago is 300 sq km. The capital of the country is Port of Spain and Scarborough is the main town in Tobago. Figure 4 shows the geographic location.

1.3.2 Economic Description

The Republic of Trinidad and Tobago has a well-established economy where, after over one hundred and forty (140) years of success in exploration and production of oil and gas, its gas-based production exceeds oil production in terms of contribution to its GDP. The country is one of the largest global exporters of methanol and ammonia from a single site and the largest exporter of methanol and ammonia to the U.S. market (Government of Trinidad and Tobago, 2016). Some recent economic statistics on Trinidad and Tobago are listed below as obtained from the Central Bank of Trinidad and Tobago (2015):

- GDP per capita:US$19,274.60
- Inflation (Headline):5.6%
- Unemployment: 3.2%
- Labour force: 649,100
- GDP at Market Prices– US$25,825.46 Mn

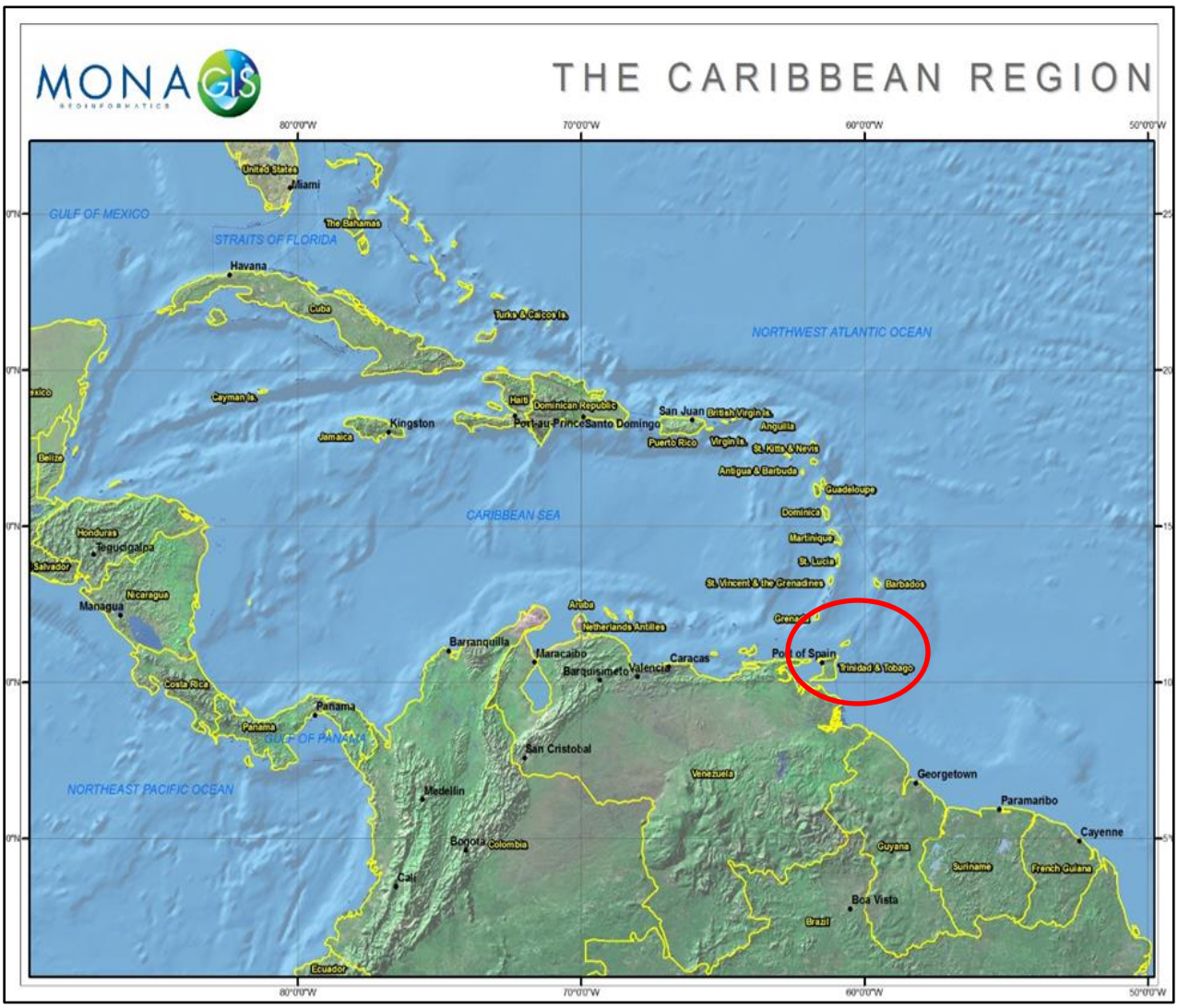

Figure 3: Location of Trinidad and Tobago relative to the Caribbean Region (Mona Geoinformatics Institute, date unknown)

Figure 4: Map of Trinidad and Tobago (Mona Geoinformatics Institute, date unknown)

1.4 MERCURY SOURCES IN TRINIDAD AND TOBAGO

There are limited published studies in Trinidad and Tobago relating to the presence of mercury in the environment however, there are numerous potential sources of mercury releases (Table 1). The economy is primarily based on oil and gas, which involves the extraction process that releases mercury into the environment. Additionally, the lack of robust policies and legislation to regulate the disposal of mercury-containing instruments results in these said instruments being comingled with the municipal solid waste and ending up in the country's landfills. According to AMAP (2013), the major mercury sources in the country are:

- Cement Production
- Oil and gas
- Dental amalgams and mercury containing devices
- Crematories and cemeteries

Table 1: Global Inventory Estimates 2010 (3 top source categories per country) (AMAP, 2013)

Country	Sector	Activity	Estimate (min)	Emission Estimate, kg	Estimate (max)
Trinidad and Tobago	Waste and other losses due to breakage (of mercury-containing devices) and disposal in landfill, etc.	Waste and other losses due to breakage (of mercury-containing devices) and disposal in landfill, etc.	18.565	71.404	235.634
	Cement production	Cement production	23.940	66.120 240.578	240.578
	Oil refining	Refining of crude oil in oil refineries	2.459	5.464	9.015

1.5 MANAGEMENT OF MERCURY IN TRINIDAD AND TOBAGO

In Trinidad and Tobago, regulations have been put in place to monitor the importation of mercury. As of 2015, persons wanting to import mercury-based products must be issued a licence in accordance with the Pesticides and Toxic Chemicals Act, where mercury is classified as a toxic chemical. Legislation also exists that targets the management of mercury. These include the Air Pollution Rules (2014), the Water Pollution Rules (2001) as amended, and the draft Waste Management (Hazardous Waste) Rules 2014.

The country is also a signatory to a number of multilateral environmental waste and chemical conventions including the Basel Convention of the Control of Transboundary Movements of Hazardous Wastes and their Disposal, the Stockholm Convention on Persistent Organic Pollutants and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. Theses conventions deal with mercury in some form however, none of them include a holistic management regime, as is the case with the Minamata Convention on Mercury.

1.6 MERCURY RESEARCH IN TRINIDAD AND TOBAGO

The 2010 National Hazardous Waste Inventory was conducted between 2004 and 2008, and this remains one of the most comprehensive and recent data repositories available for local data on hazardous chemicals. This report indicated multiple sources of mercury, with importation leading the list. During that period, the country experienced significant growth and development as its industrial, manufacturing and agricultural sectors all expanded, which accounted for the high importation of mercury containing products. These products would have been utilised across a range of areas such as industrial, manufacturing, medical and household. Further research has been undertaken since that time, albeit on a more limited scale.

For instance, Pereira and Teelucksingh (2009) conducted a study on two middle aged men from Trinidad, both of whom were avid consumers of fish (mainly canned tuna and locally-sourced shark). They both complained of severe lower back and abdominal pains and they also experienced progressive weakness, fatigue and weight loss over a period of time. Their blood samples were analysed and mercury levels were found to be high. This was determined to be due to the presence of mercury in the fish consumed by the patients. The bioaccumulation of mercury in fish was due to exposure from its presence in waterways.

Another study executed by Mohammed et al (2011) found high levels of mercury in samples taken from the Caroni Lagoon located on the west coast of Trinidad. Values ranged between 0.33 and 0.60 mg/kg which is above the IAEA tolerable value of 0.22 mg/kg for metals in fish. One of the contributing factors to the levels of mercury in the water systems could have been the improper disposal of mercury containing products. Some of these potential sources of mercury were mercury metal, scientific instruments, lightbulbs, batteries, thermostats and dental cement as these were identified by the United Nations when the Government of the Republic of Trinidad and Tobago submitted the "Mercury in Trinidad and Tobago" Report for the Global Assessment (AMAP, 2013).

More recently a study was conducted by Beckles et al (2016), to assess the impact of contaminants produced by the Guanapo landfill site on the surrounding environment. Upon testing of water and sediment in the six surrounding sample sites, it was found that most of the sites had levels of concern of 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 tested. Mercury levels were most likely due to landfill leachates as mercury containing products are typically disposed of indiscriminately together with general waste.

Other studies conducted in the country investigated the methods of disposal of amalgam waste by dentists. The most popular methods of disposal included disposal of the amalgam waste in the trash or by washing it down the sink. This is elaborated upon further in Section 7.2 of this report.

1.7 THE MERCURY STORAGE AND DISPOSAL PROJECT IN THE CARIBBEAN: JAMAICA, SURINAME AND TRINIDAD AND TOBAGO

The BCRC-Caribbean collaborated with the Chemicals and Waste Branch of UNEP DTIE and received funding from the Norway ODA for the "Mercury Storage and Disposal Project in the Caribbean: Jamaica, Trinidad and Tobago and Suriname." This project would assist these three (3) countries in their efforts to accede, ratify and implement the Minamata Convention on Mercury.

The main outputs of the Project include:

- Establishment of a decision making process at the national level;
- Gaining an understanding of the mercury waste streams and management options i.e. disposal and storage;

- Understanding the regulatory framework for the environmentally sound management of mercury;
- Enhancing countries' understanding of the mercury waste and commodity issues as it relates to surplus mercury;
- Development of a national storage and waste management action plan; and
- Increasing awareness and education on the issue.

A key component of the Project is the development of national inventories of mercury releases in each country, for use in quantifying the mercury status in the respective territories.

1.8 METHODOLOGY

A national project inception workshop was held to introduce key stakeholders from Trinidad and Tobago to the Minamata Convention and to the project activities. Following this, a National Working Group was formed comprising of representatives from the core group of stakeholders such as the ministerial bodies and associated agencies including:

- The Environmental and Policy Planning Division, Ministry of Planning and Development
- The Pesticides and Toxic Chemicals Control Board, Ministry of Health
- Tobago House of Assembly - Department of Natural Resources and the Environment
- The Environmental Management Authority
- The Trinidad and Tobago Solid Waste Management Company Limited
- University of the West Indies, Trinidad
- University of Trinidad and Tobago
- Trinidad & Tobago Manufacturers' Association
- Council of Presidents of the Environment

- Atlantic LNG (Liquefied Natural Gas)

Data collection was very important for the inventory in order to derive the necessary calculations for mercury releases. The National Working Group further identified stakeholders who may be major contributors to mercury emissions and coordinated their efforts to obtain data from these stakeholders. The group collaborated with the BCRC-Caribbean in the development of questionnaires for each of the following sectors:

- Oil and Gas
- Ammonia and Methanol
- Power Generation
- Mercury and Mercury Containing Devices
- Cement
- Dental
- Waste
- Funeral Homes

The questionnaires were then distributed to the appropriate personnel within these sectors to gather relevant data for the inventory. All questionnaires developed are attached as Annex 1 to this report.

This inventory was conducted in 2016 using the UNEP's Toolkit for Identification and Quantification of Mercury Releases (Inventory Level 1). The Toolkit is based on mass balances for each mercury release source type. Inventory Level 1 works with pre-determined factors based largely on assumptions on 2015 population data. These assumptions are used to calculate mercury inputs to society and releases, the so-called default input factors and default output distribution factors. These factors were derived from data on mercury inputs and releases from the relevant mercury source types from available literature and other relevant sources such as the International Energy Agency's website.

The Toolkit consisted of a Microsoft Excel spreadsheet with predetermined formulae in certain cells to automatically calculate mercury inputs and releases. Data was separated based on the following sectors or steps:

- Energy Consumption and Fuel Production

- Domestic Production of Metals and Raw Materials
- Domestic Production and Processing with Intentional Mercury Use
- Waste Treatment and Recycling
- General Consumption of Mercury in Products, as Metal Mercury and as Mercury Containing Substances
- Crematoria and Cemeteries
- Miscellaneous Mercury Sources

The completed inventory Toolkit is available as Annex 2.

NOTE: When available, data for the year 2015 has been used for this inventory. For some data sets however, data from that year may not have been available and as such, the corresponding year for all data retrieved has been indicated for that data group.

The National Working Group developed an Action Plan for achieving the objectives of the project which is available in Annex 3. Table 2 below provides the project timeline for the activities of the project.

Table 2: General Project Timeline 2016

April	May	June	July	Aug	Sept	Oct	Nov	Dec
Preparation for Workshops		National Inception Workshop	Data Collection, Questionnaires, Draft Report				Results Workshops	Closure of Project

1.9 DATA GAPS

The biggest challenge in completing the inventory was acquiring the adequate data to complete the various sections that were applicable to the country, in a very short timeframe. In order to collect the information required, questionnaires based on various sectors that emit mercury were used (attached as Annex I) and distributed to the relevant personnel. However, due to the limited voluntary responses received, alternate data sources had to be utilised, as is detailed below.

The Ministry of Energy and Energy Industries was very helpful in providing information on the oil and gas production for the country in 2015, which facilitated the completion of the energy

section of the inventory. The documents from the Ministry also provided data on the volume of crude oil refined and the amount of natural gas processed.

Data for waste treatment and recycling section were supplied by the Trinidad and Tobago Solid Waste Management Company (SWMCOL), and included information on the total quantity of garbage collected per year in the various landfills, as well as additional information on the air quality at one of the sites, the Beetham Landfill. However, data on sections such as "Incineration and open burning of medical waste" was not available. In future data gathering, it is to be noted that the Environmental Management Authority manages the Certificates of Environmental Clearance (CECs) for waste handling facilities which would generally include relevant data from air or effluent monitoring. The data can be formally requested. The Ministry of Health may also be able to provide monitoring data for the incineration of medical waste.

Data for the section on mercury products and substances was obtained from the questionnaires. For the first section *(Use and disposal of products)* questionnaires were distributed to dentists. The response rate was only 7% which is low, but from the data obtained, assumptions could be made. The low response rate however, did not hinder the completion of the inventory as information was also gathered from external sources who confirmed that a number of dentists still use amalgam fillings. Also for other mercury products, exact figures were not obtained however, information provided by the Environmental Policy and Planning Division of the Ministry of Planning and Development suggested that these instruments were indeed present in the country.

The main priorities for a future assessment would be to obtain the exact values for those steps in the inventory that are data scarce. There were cases where this data was simply not recorded in the country which is a situation that needs to be rectified. In addition, a more efficient method of distributing the questionnaires is required and it is recommended that direct or face-to-face distribution may be more rewarding as this may encourage persons to fill them out.

2.0 RESULTS AND DISCUSSION

An aggregated presentation of the results obtained from the inventory for the main groups of mercury release sources is presented in Figures 5 to 11 below.

As shown in Table 3, the source groups that contribute to the input of mercury are:

- Oil and gas production

- Use and disposal of other products

- Cement Production

- Crematoria and cemeteries

- Application, use and disposal of dental amalgam fillings

NOTE: With respect to the waste deposition, only 10% represent approximately the mercury input to waste from materials which were not quantified individually in Inventory Level 1 of the Toolkit.

The origin of mercury in waste and waste water produced in the country is mercury in products and materials. Waste fractions and waste water therefore do not represent original mercury inputs to society (except imported waste). Waste and waste water may however, represent substantial flows of mercury through society.

Table 3: Summary of Total Mercury Inventory Results for Trinidad and Tobago 2016

Source category	Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y							Percent of total releases *3*4
		Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal	Total releases *3*4*5	
Coal combustion and other coal use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Other fossil fuel and biomass combustion	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Oil and gas production	308.6	24.1	58.2	0.0	39.1	0.0	48.4	170	26%
Primary metal production (excl. gold production by amalgamation)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Gold extraction with mercury amalgamation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Other materials production	109.2	81.9	0.0	0.0	27.3	0.0	0.0	109	17%
Chlor-alkali production with mercury-cells	-	-	-	-	-	-	-	0	0%
Other production of chemicals and polymers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Production of products with mercury content*1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%

Source category	Estimated Hg input, Kg Hg/y	Estimated Hg releases, standard estimates, Kg Hg/y							Percent of total releases *3*4
		Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal	Total releases *3*4*5	
Application, use and disposal of dental amalgam fillings	27.3	0.5	9.1	1.3	1.0	4.6	4.6	21	3%
Use and disposal of other products	308.5	21.8	24.1	18.7	0.0	221.3	22.7	309	47%
Production of recycled metals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Waste incineration and open waste burning*2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0%
Waste deposition*2	2,611.5 (actual input = 261)	26.1	0.3	0.0	-	-	-	26	4%
Informal dumping of general waste *2*3	-	-	-	-	-	-	-	0	0%
Waste water system/treatment *4	-	-	-	-	-	-	-	0	0%
Crematoria and cemeteries	28.9	17.8	0.0	11.1	0.0	0.0	0.0	29	4%
TOTALS (rounded) *1*2*3*4*5	900	170	90	30	70	230	80	660	101%

Notes to table:

*1 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: To avoid double counting of mercury inputs from waste and products in the input TOTAL, only 10% of the mercury input to waste incineration, 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 the Toolkit.

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

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

*5: Total inputs do not necessarily equal total outputs due to corrections for double counting (see notes*1-*3) and because some mercury follows products/metal mercury which are not sold in the same country or in the same year.

2.1 MERCURY RELEASE SOURCE TYPES PRESENT

Table 4 shows which mercury release sources were identified as present or absent in the country. Only sources of mercury positively identified as present are included in the quantitative assessment.

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

Source category	Source present?
	Y/N/?
ENERGY CONSUMPTION	
Coal combustion in large power plants	N
Other coal uses	N
Combustion/use of petroleum coke and heavy oil	N
Combustion/use of diesel, gasoil, petroleum, kerosene, LPG and other light to medium distillates	N
Use of raw or pre-cleaned natural gas	N
Use of pipeline gas (consumer quality)	N
Biomass fired power and heat production	N
Charcoal combustion	N
FUEL PRODUCTION	
Oil extraction	Y
Oil refining	Y
Extraction and processing of natural gas	Y
PRIMARY METAL PRODUCTION	
Mercury (primary) extraction and initial processing	N
Production of zinc from concentrates	N
Production of copper from concentrates	N
Production of lead from concentrates	N
Gold extraction by methods other than mercury amalgamation	N
Alumina production from bauxite (aluminium production)	N
Primary ferrous metal production (pig iron production)	N
Gold extraction with mercury amalgamation - without use of retort	N
Gold extraction with mercury amalgamation - with use of retorts	N
OTHER MATERIALS PRODUCTION	
Cement production	Y
Pulp and paper production	N
PRODUCTION OF CHEMICALS	
Chlor-alkali production with mercury-cells	N
VCM production with mercury catalyst	N
Acetaldehyde production with mercury catalyst	N

PRODUCTION OF PRODUCTS WITH MERCURY CONTENT	
Hg thermometers (medical, air, lab, industrial etc.)	N
Electrical switches and relays with mercury	N
Light sources with mercury (fluorescent, compact, others: see guideline)	N
Batteries with mercury	N
Manometers and gauges with mercury	N
Biocides and pesticides with mercury	N
Paints with mercury	N
Skin lightening creams and soaps with mercury chemicals	N
USE AND DISPOSAL OF PRODUCTS WITH MERCURY CONTENT	
Dental amalgam fillings ("silver" fillings)	Y
Thermometers	Y
Electrical switches and relays with mercury	Y
Light sources with mercury	Y
Batteries with mercury	N
Polyurethane (PU, PUR) produced with mercury catalyst	N
Paints with mercury preservatives	N
Skin lightening creams and soaps with mercury chemicals	Y
Medical blood pressure gauges (mercury sphygmomanometers)	Y
Other manometers and gauges with mercury	Y
Laboratory chemicals	Y
Other laboratory and medical equipment with mercury	Y
PRODUCTION OF RECYCLED OF METALS	
Production of recycled mercury ("secondary production")	N
Production of recycled ferrous metals (iron and steel)	N
WASTE INCINERATION	
Incineration of municipal/general waste	N
Incineration of hazardous waste	N
Incineration and open burning of medical waste	Y
Sewage sludge incineration	N
Open fire waste burning (on landfills and informally)	Y
WASTE DEPOSITION/LANDFILLING AND WASTE WATER TREATMENT	
Controlled landfills/deposits	Y
Informal dumping of general waste *1	N
Waste water system/treatment	N
CREMATORIA AND CEMETERIES	
Crematoria	Y
Cemeteries	Y

It should be noted however, that the presumably minor mercury release source types shown in Table 5 were not included in the detailed source identification and quantification work as their contributions would be negligible. These may however be present in some countries.

Table 5: Miscellaneous potential mercury sources not included in the quantitative inventory; with preliminary indication of possible presence in the country.

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

2.2 PRESENTATION OF RESULTS

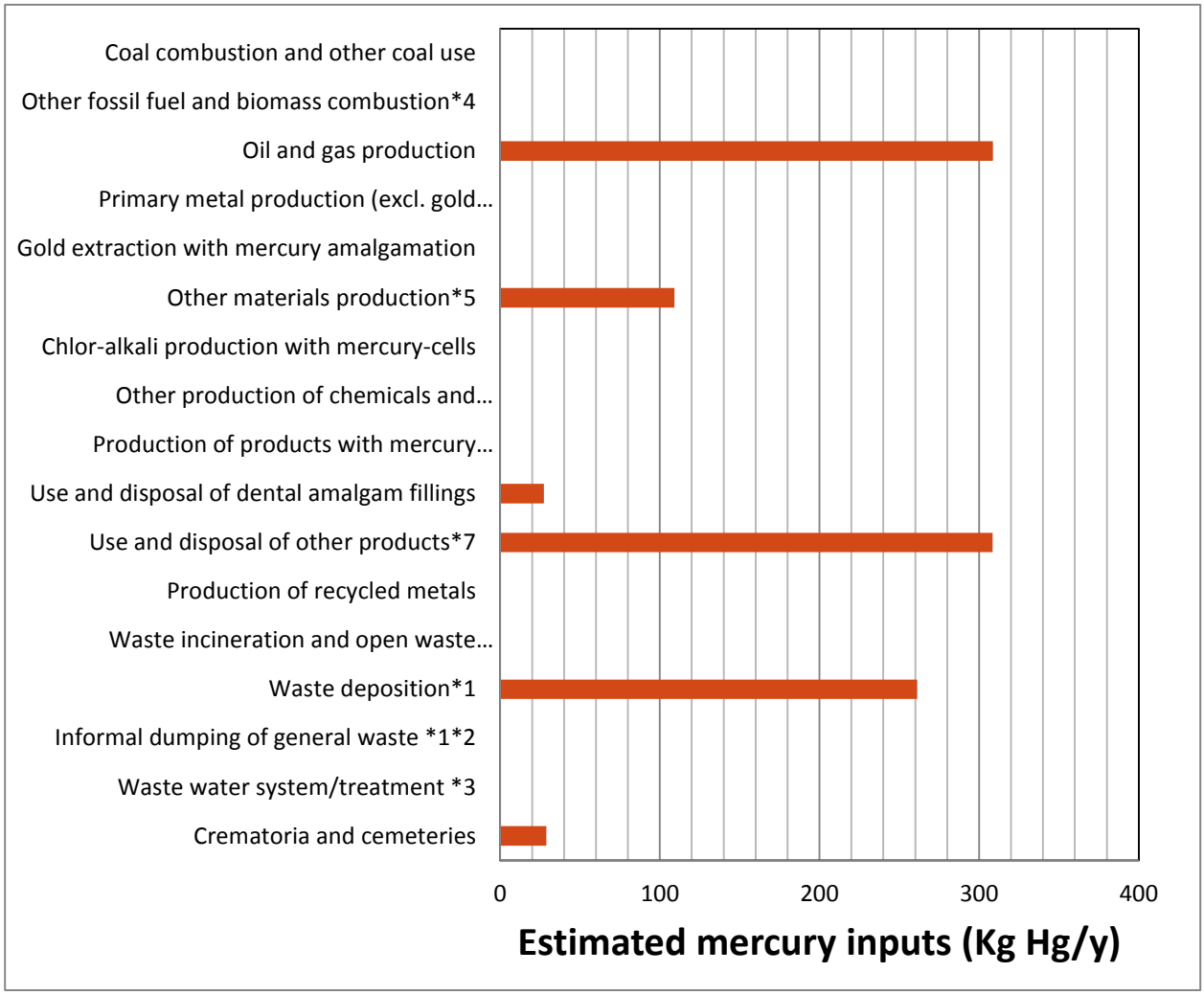

Figure 5: Estimated Mercury Inputs in Trinidad and Tobago, 2016 (kg of Mercury per year)

Figure 5 shows the estimated mercury inputs into the environment. According to the figure, both oil and gas production as well as, use and disposal of mercury products are the largest contributors with just over 300 kg of mercury released per year respectively.

For oil and gas production, these values relate to the extraction and refining of crude oil and also the extraction and processing of natural gas. Trinidad and Tobago has an economy that is based primarily on industrial activity, with an emphasis on petroleum and petrochemical production, so much so that the country is regarded as the leading producer of oil and gas in the Caribbean. When extraction of the raw materials for processing takes place, mercury is released; primarily from petroleum and natural gas exploration as well as from the production and multiple

processing activities. This occurs as mercury is a trace component in fossil fuels which includes crude oil, natural gas, condensates, coal, tar and bitumen. The country also has several downstream industrial activities such as the refining of crude oil and the purifying of natural gas.

With respect to the use and disposal of products containing mercury, this refers to products such as lightbulbs, clinical thermometers and skin whitening creams, and waste deposition. While Trinidad and Tobago is not a producer of mercury containing products, a number of products are imported into the country by pharmaceutical companies and there are no measures in place to ensure the proper disposal of these products.

In regards to waste deposition, while Table 3 showed that the estimated mercury input per year was 2,611.5 kg/y, this value was determined from estimating the total amount of waste going to waste disposal sites and therefore included waste that would be represented by other sectors such as *Use and Disposal of Products*. In order to account for this double counting, only 10% of the mercury input for *Waste Deposition* is included in the total for mercury inputs based on assumptions made in the Toolkit.

Other materials production refers to cement production which was seen as being the third largest contributor to Hg inputs. This value is based on assumptions in the Toolkit on the raw materials, type of fuel and cleaning methods used for the process. Refer to Section 4.1 for further clarifications on cement production. Crematoria and cemeteries were responsible for 28.9 kg of mercury per year while the use and disposal of dental amalgam fillings contributed to 27.3 kg of mercury per year, the lowest among the reported categories.

NOTE: Figure 5 shows the contribution of various categories into the environment as a whole, whereas the following graphs look at the values in mediums: air, water and land.

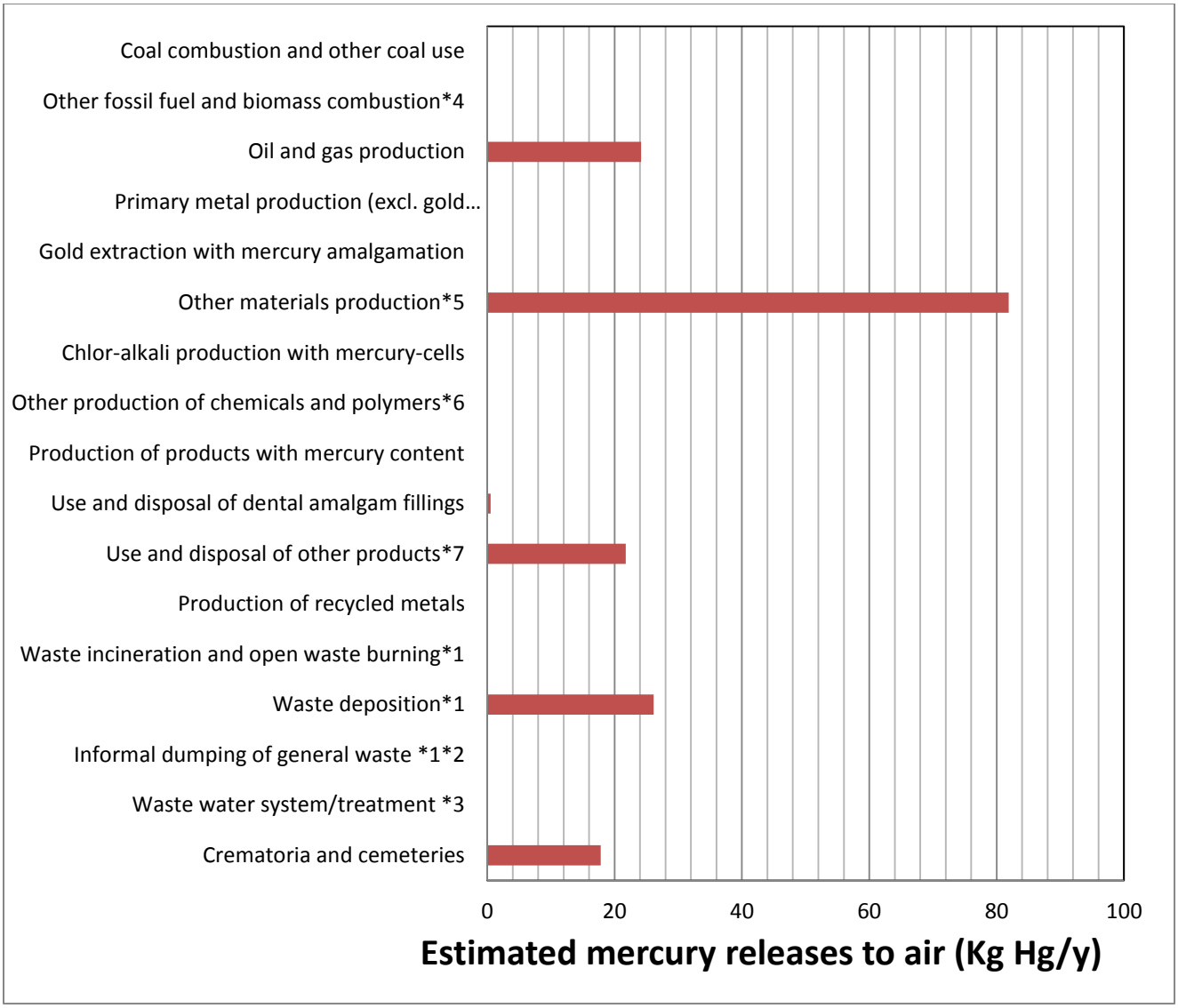

Figure 6: Estimated Mercury Releases into the Air in Trinidad and Tobago 2016 (kg of Mercury per year)

Cement production was listed as accounting for the highest estimated mercury releases to air at 81.9 kg Hg annually. This is due to the release of fumes in the cement kilns which are assumed to contain potentially significant amounts of mercury due to the type of fuel used. Refer to Section 4.1 for clarifications.

Waste deposition accounted for the second highest estimated releases of mercury to air with 26.1 kg annually. This figure was determined by taking into account estimated releases to air for controlled waste disposal sites, diffuse deposition under some control, informal local deposition of industrial production waste and informal dumping of general waste.

Oil and gas production also released a significant quantity of mercury into the atmosphere since this process requires the breaking down of raw materials. Mercury is a naturally occurring element in the earth's crust and it is a component of the raw materials used in oil and gas production. During processing, fumes are released into the atmosphere via stacks which would contain elements of mercury.

The disposal of mercury containing products, as listed previously, also accounted for a notable value in terms of releases to air, as the instruments may break when discarded causing the mercury contained to be released.

Cremations are another source of air pollution. Mercury may be present in the body due to medical implants or toxins that bio-accumulated, but most commonly, mercury in the deceased tend to be due to the presence of dental amalgam, which releases mercury into the atmosphere through fumes when the bodies are burnt.

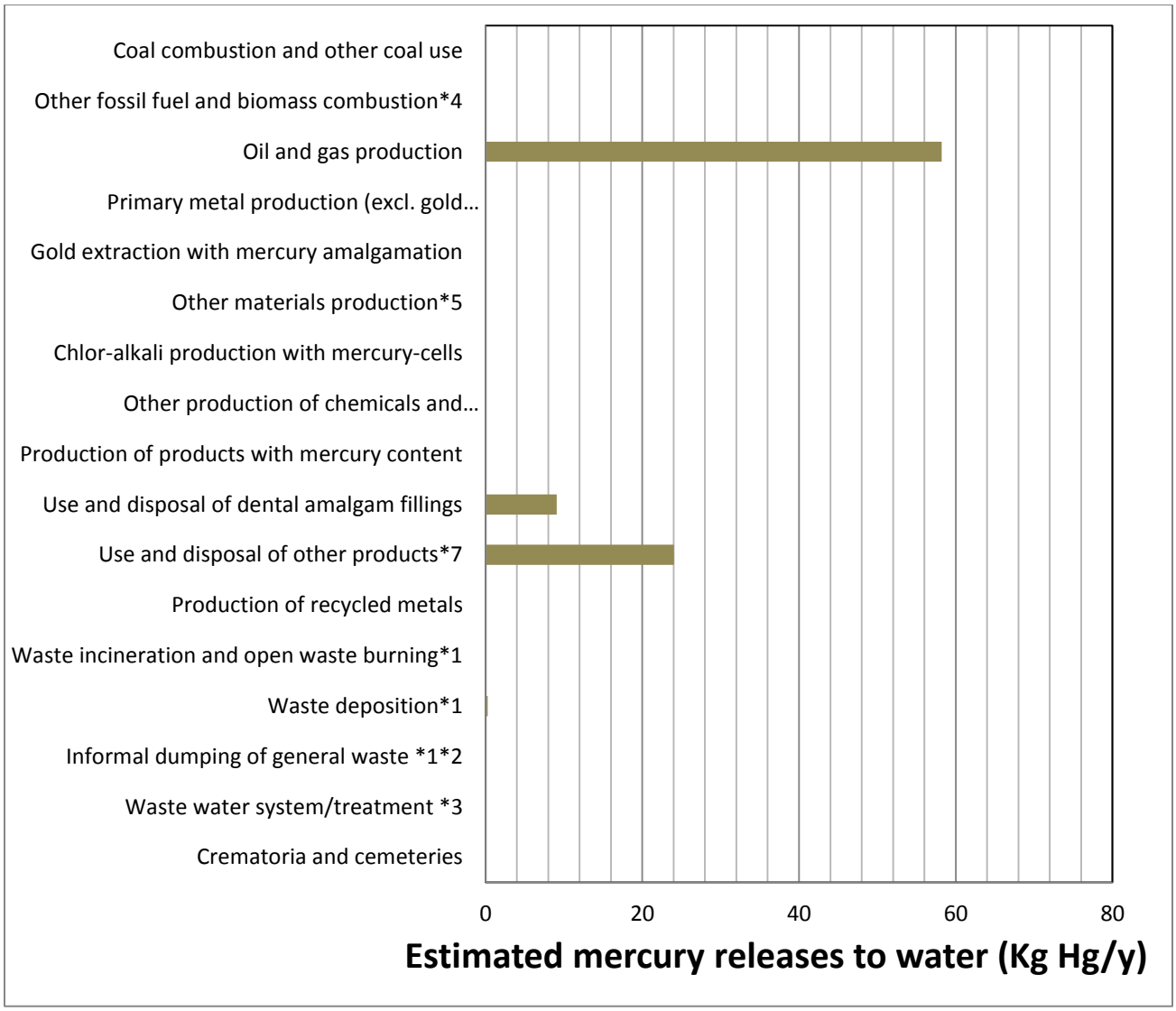

Figure 7: Estimated Mercury Releases into the Water in Trinidad and Tobago, 2016 (kg of Mercury per year)

Oil and gas is the largest contributor to mercury emissions into the water (Figure 7) possibly due to the offshore extracting and processing activities. The improper disposal of mercury-containing products release mercury into the water, possibly due to breakage and the liquid state of mercury at room temperature. Dental amalgam fillings account for the third largest contributor of mercury releases to water as a number of dentists indicated that they dispose of the amalgam by washing it down the sink.

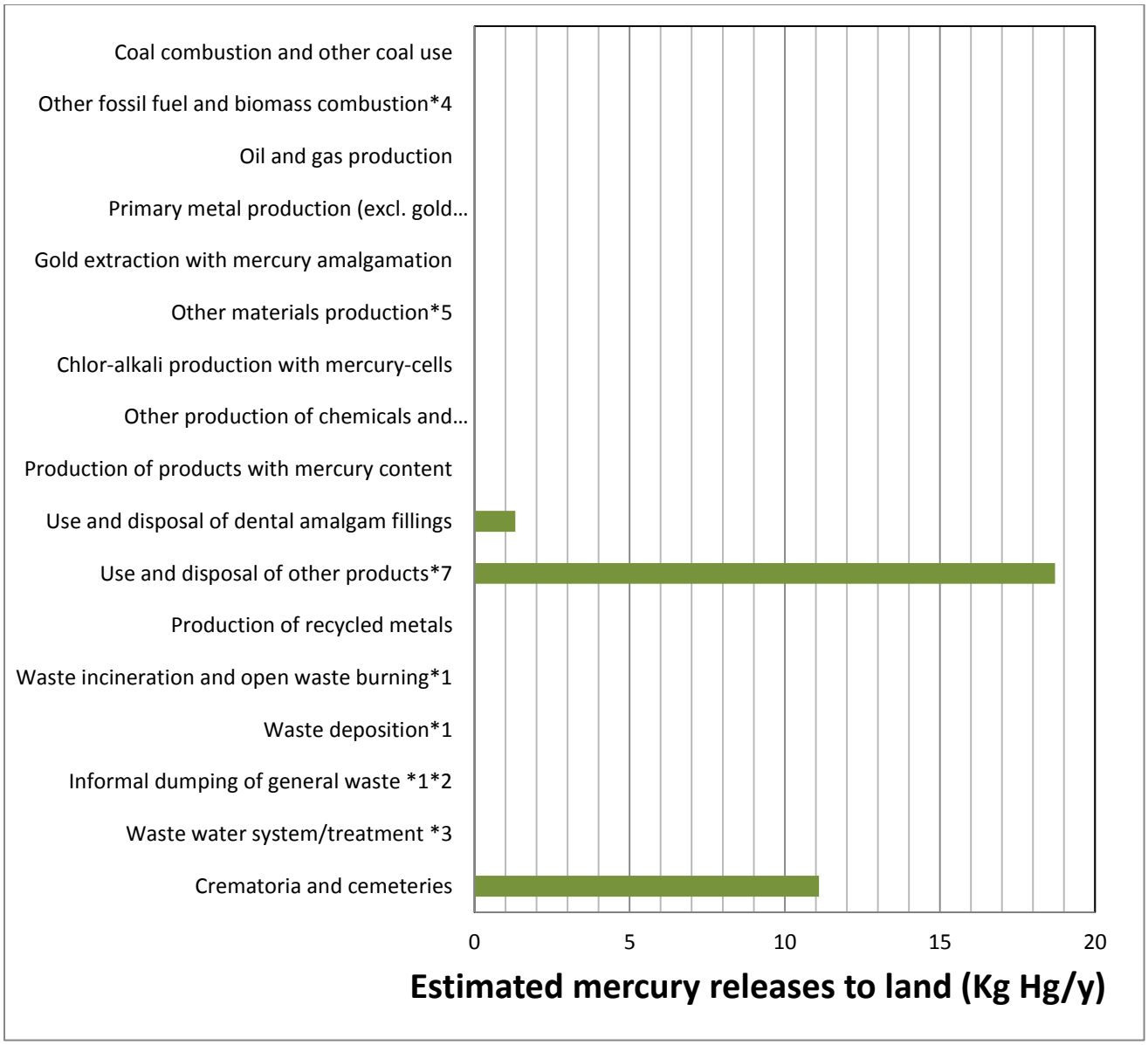

Figure 8: Estimated Mercury Releases to Land in Trinidad and Tobago, 2016 (kg of Mercury per year)

For the estimated mercury releases to land (Figure 8), the disposal of mercury containing products ranked as the highest as most of the mercury containing products are co-mingled with household waste, which eventually end up in the country's landfills. Also, as bodies are buried with amalgam fillings, crematoria and cemeteries results in relatively high releases of mercury to land.

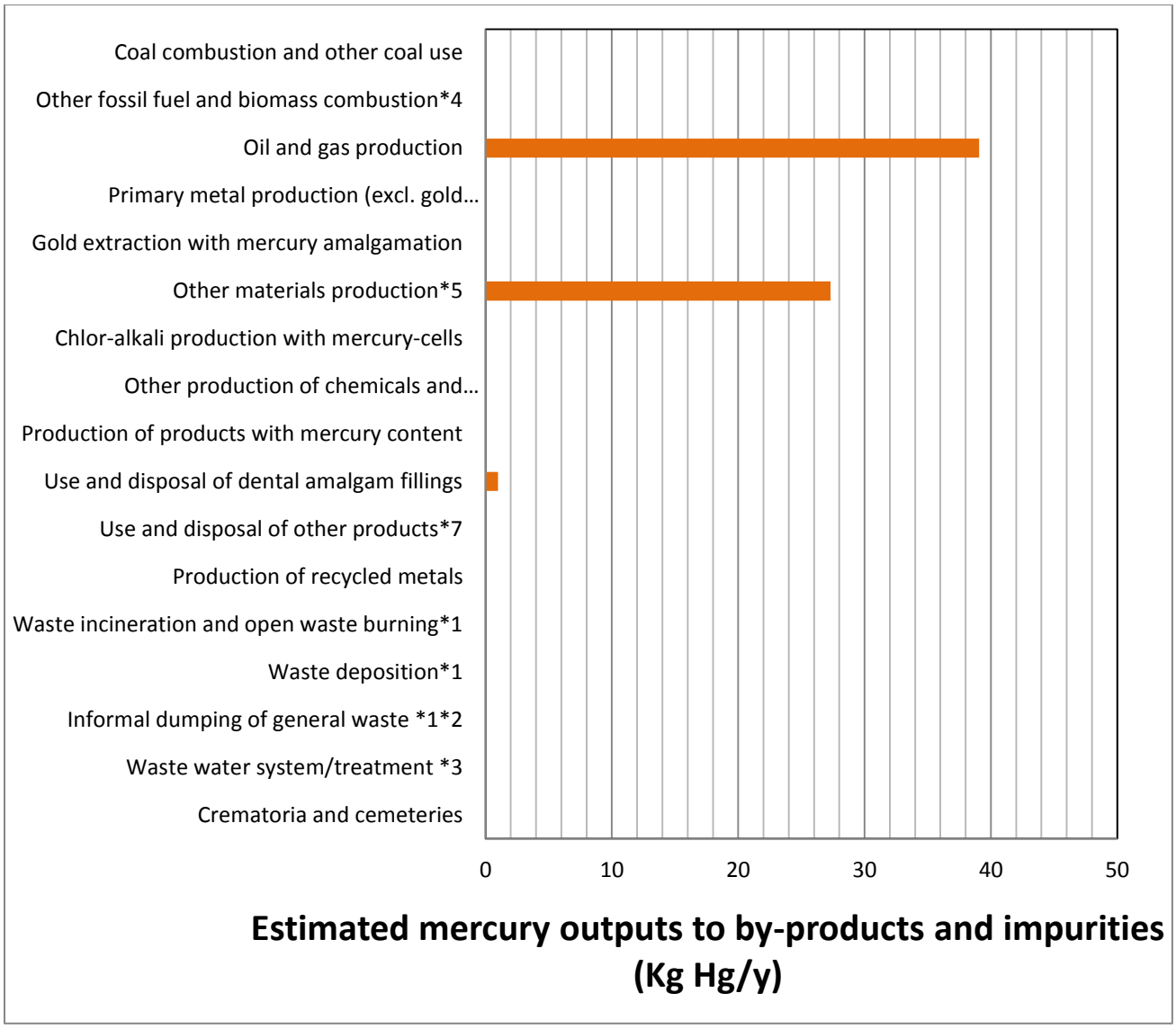

Figure 9: Estimated Mercury Outputs to By-products and Impurities in Trinidad and Tobago, 2016 (kg of Mercury per year)

Oil and natural gas production generates a number of by-products from refining and processing that would contain traces of mercury in them as well, resulting in the highest output concentrations as seen in Figure 9. Some by products produced from the refining of petroleum include asphalt, kerosene, gasoline, diesel fuel and motor oil. However petroleum is used in everyday consumer products such as shampoos, candles, hand lotions and other products as well. Cement production also accounted for a high amount of estimated Hg outputs to by-products and impurities due to the assumed co-incineration of waste in the cement kilns and by-production of mercury containing products such as incinerator gypsum from acid flue gas cleaning residues.

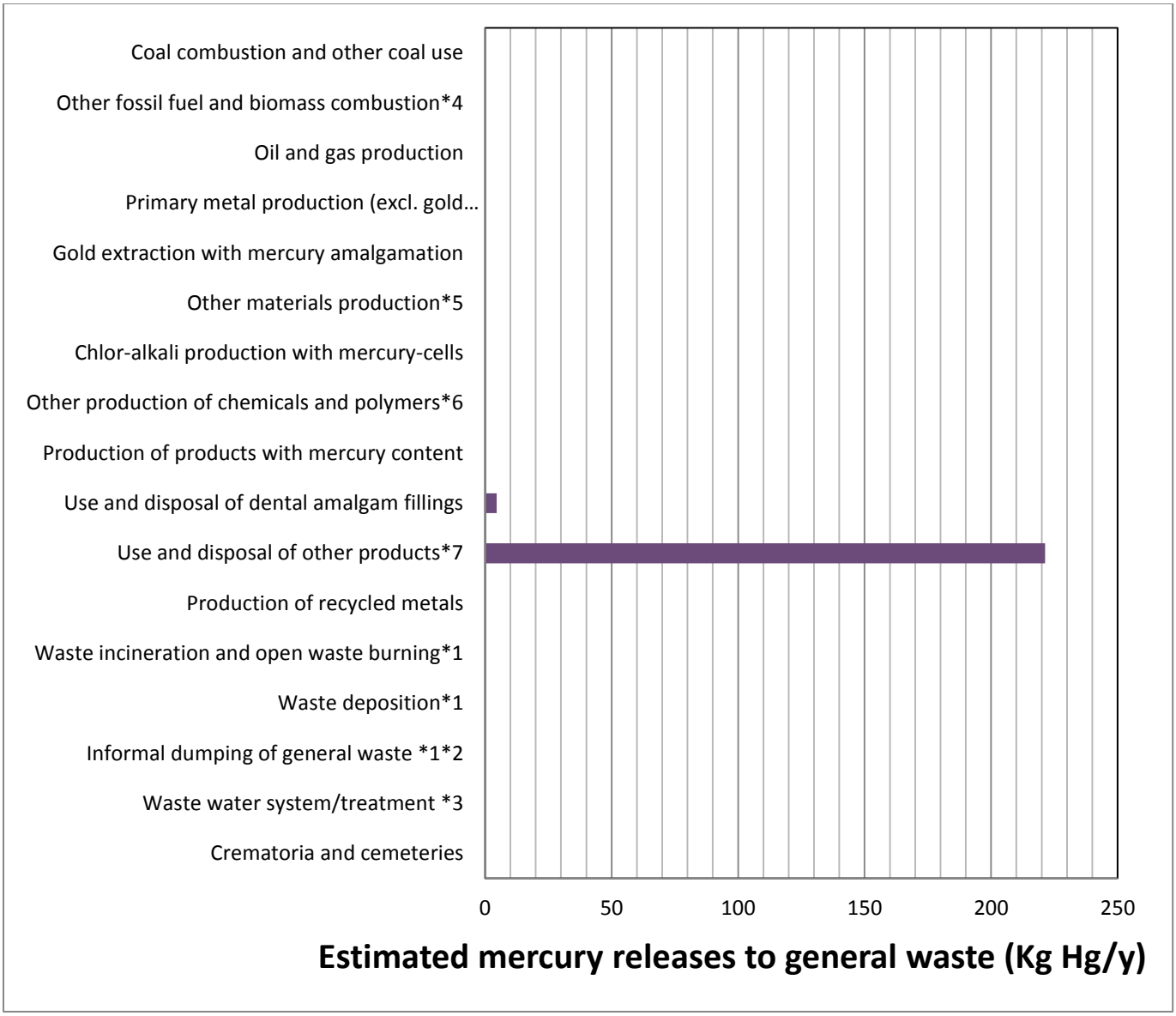

Figure 10: Estimated Mercury Releases to General Waste in Trinidad and Tobago, 2016 (kg of Mercury per year)

Invariably mercury containing products are disposed of when co-mingled with the household or municipal solid waste and end up in the landfill, resulting in the values seen in Figure 10. This is largely due to the absence of waste management legislation that regulates proper disposal of mercury and other waste streams in general. Additionally, the lack of public education on the hazards of mercury and mercury containing products has resulted in items such as light bulbs being mixed with household waste.

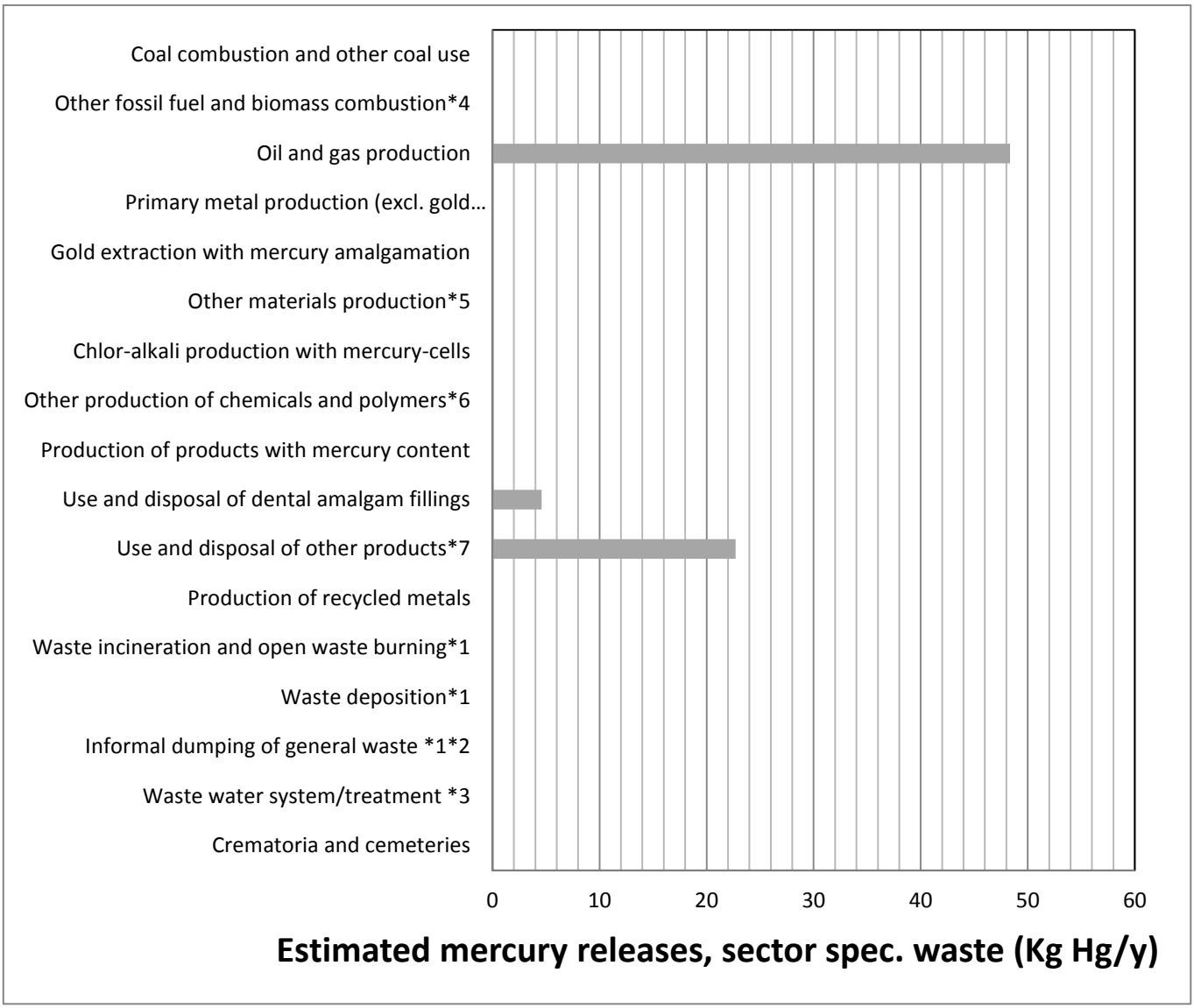

Figure 11: Estimated Mercury Releases, Sector Specific Waste in Trinidad and Tobago, 2016 (kg of Mercury per year)

Oil and gas production again dominates the estimated mercury releases to sector specific waste treatment and disposal which refers to waste from industry and consumers which is collected and treated in separate systems.

Notes on the charts

*1: Waste is not an original source to mercury input to society. To avoid double counting of mercury inputs from waste and products in the graphs, only 10% of the mercury input to waste incineration, waste deposition and informal dumping is included in the chart 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. See Appendix 1 to the Inventory Level1 Guideline for more explanation.

*2: Waste is not an original source to mercury input to society. The estimated quantities include mercury in products which has also been accounted for under each product category. To signal the importance of this release pathway, the release to land from informal dumping of general waste has NOT been subtracted in the charts.

*3: Wastewater is not an original source to mercury input to society. The estimated input and release to water include mercury amounts which have also been accounted for under each source category. To avoid double counting, input to waste water system/treatment have been subtracted automatically in the charts. To signal the importance of this release pathway, releases to water via waste water system/treatment has NOT been adjusted in the charts in spite of double counting.

*4: Includes petroleum coke, heavy oil, diesel, gasoil, petroleum, kerosene, natural gas, charcoal and other biofuels

*5: Includes production of cement and pulp and paper.

*6: Includes production of VCM and acetaldehyde

*7: Includes thermometers, electrical switches and relays, light sources, batteries, polyurethane with Hg catalyst, paints and skin creams with Hg, blood pressure gauges and other manometers, lab chemicals, and other lab and medical uses.

Detailed presentation of mercury inputs and releases for all mercury release source types present in the country are shown in the following report sections.

The Toolkit spreadsheets used in the development of this inventory are posted along with this report, or can be submitted upon request.

2.3 SUMMARY OF MERCURY INPUTS TO SOCIETY

Mercury inputs to society refer to the quantity of mercury made available for potential releases through economic activities in the country. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, fluorescent light bulbs, etc. It also includes mercury mobilised via extraction and use of raw materials which contain mercury in trace concentrations. Table 6 below summarises the mercury inputs to society for Trinidad and Tobago.

Table 6: Summary of mercury inputs to society

Source category	Source present?			Estimated Hg input, Kg Hg/y
	Y/N/?	Activity rate	Unit	Standard estimate
FUEL PRODUCTION				
Oil extraction	Y	47,024,996	Crude oil produced, t/y	160
Oil refining	Y	5,416,042	Crude oil refined, t/y	18
Extraction and processing of natural gas	Y	1,302,603,266	Gas produced, Nm^3/y	130
OTHER MATERIALS PRODUCTION				
Cement production	Y	840,087	Cement produced, t/y	109
USE AND DISPOSAL OF PRODUCTS WITH MERCURY CONTENT				
Dental amalgam fillings ("silver" fillings)	Y	1,349,667	Number of inhabitants	27
Thermometers	Y	0	Items sold/y	0
Electrical switches and relays with mercury	Y	1,349,667	Number of inhabitants	187
Light sources with mercury	Y	1,919,969	Items sold/y	48
Skin lightening creams and soaps with mercury chemicals	Y	0	Cream or soap sold, t/y	0
Medical blood pressure gauges (mercury sphygmomanometers)	Y	0	Items sold/y	0
Other manometers and gauges with mercury	Y	1,349,667	Number of inhabitants	7
Laboratory chemicals	Y	1,349,667	Number of inhabitants	13
Other laboratory and medical equipment with mercury	Y	1,349,667	Number of inhabitants	53
WASTE INCINERATION				
Open fire waste burning (on landfills and informally)	Y	0	Waste burned, t/y	0
WASTE DEPOSITION/LANDFILLING AND WASTE WATER TREATMENT				
Controlled landfills/deposits	Y	522,309	Waste landfilled, t/y	**2,612 (actual input = 261)**
CREMATORIA AND CEMETERIES				
Crematoria	Y	7,134	Corpses cremated/y	18
Cemeteries	Y	4,442	Corpses buried/y	11
TOTAL of quantified inputs*1*2*3				**900**

Notes:

*1: 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.

See Appendix 1 to the Inventory Level1 Guideline for more explanation.

*2: 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.

*3: The estimated input and release to water include mercury amounts which have also been accounted for under each source category.

To avoid double counting, input to, and release to water from, waste water system/treatment have been subtracted automatically in the TOTALS.

It is to be noted that the following source sub-categories made the largest contributions to mercury inputs to society according to the Toolkit:

1. Controlled/Landfill deposits (261 kg Hg/y)
2. Electrical switches and relays with mercury (187 kg Hg/y)
3. Oil Extraction (160 kg Hg/y)
4. Extraction and Processing of Natural Gas (130 kg Hg/y)
5. Cement Production (109 kg Hg/y)

2.4 SUMMARY OF MERCURY RELEASES

In the Table 7 below, a summary of mercury releases from all source categories present is given. The table addresses releases to air (the atmosphere), to water (marine and freshwater bodies, including via waste water systems), to land, to general waste, and to sectors specific waste treatment/disposal. An additional output pathway is "by-products and impurities" which designates mercury flows back into the market through by-products and products where mercury was not intentionally used in production but is present due to unavoidable circumstances (such as being naturally present in the raw materials used). Table 8 provides a more detailed description and definition of the output pathways.

Table 7: Summary of mercury releases

Source category	Estimated Hg releases, standard estimates, Kg Hg/y					
	Air	Water	Land	By-products and impurities	General waste	Sector specific waste treatment /disposal
FUEL PRODUCTION						
Oil extraction	0.0	32.0	0.0	0.0	0.0	0.0
Oil refining	4.6	0.2	0.0	0.0	0.0	2.8
Extraction and processing of natural gas	19.5	26.1	0.0	39.1	0.0	45.6
OTHER MATERIALS PRODUCTION						
Cement production	81.9	0.0	0.0	27.3	0.0	0.0
USE AND DISPOSAL OF PRODUCTS WITH MERCURY CONTENT						
Dental amalgam fillings ("silver" fillings)	0.5	9.1	1.3	1.0	4.6	4.6
Thermometers	0.0	0.0	0.0	0.0	0.0	0.0
Electrical switches and relays with mercury	18.7	0.0	18.7	0.0	149.7	0.0
Light sources with mercury	2.4	0.0	0.0	0.0	45.6	0.0
Skin lightening creams and soaps with mercury chemicals	0.0	0.0	0.0	0.0	0.0	0.0
Medical blood pressure gauges (mercury sphygmomanometers)	0.0	0.0	0.0	0.0	0.0	0.0
Other manometers and gauges with mercury	0.7	2.0	0.0	0.0	4.0	0.0
Laboratory chemicals	0.0	4.4	0.0	0.0	4.4	4.5
Other laboratory and medical equipment with mercury	0.0	17.6	0.0	0.0	17.6	18.2
WASTE INCINERATION						
Incineration and open burning of medical waste	0.0	0.0	0.0	0.0	0.0	0.0
Open fire waste burning (on landfills and informally)	0.0	0.0	0.0	0.0	0.0	0.0
WASTE DEPOSITION/LANDFILLING AND WASTE WATER TREATMENT						
Controlled landfills/deposits	26.1	0.3	0.0	-	-	-
CREMATORIA AND CEMETERIES						
Crematoria	17.8	0.0	0.0	-	0.0	0.0
Cemeteries	0.0	0.0	11.1	-	0.0	0.0
TOTAL of quantified releases*1*2	**170.0**	**90.0**	**30.0**	**70.0**	**230.0**	**80.0**

Notes to table above:

*1: 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.

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

Table 8: Description of the types of results

Calculation result type	Description
Estimated Hg input, Kg Hg/y	The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury amount in coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example from: • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources such as small-scale gold mining, informal burning of waste with fluorescent lamps, batteries, thermometers.
Water	Mercury releases to aquatic environments and to 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 gas cleaning systems on coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps
Land	Mercury releases to the terrestrial environment: General soil and ground water. For example releases from: • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction. • Uncollected waste products dumped or buried informally • Local un-confined releases from industry such as on site hazardous waste storage/burial • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer) • Application on land, seeds or seedlings of pesticides with mercury compounds

Calculation result type	Description
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 mercury trace concentrations • Chlorine and sodium hydroxide produced with mercury-based chlor-alkali technology; with mercury trace concentrations • Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations)
General waste	General waste: Also called municipal waste in some countries. Typically household and institution waste where the waste undergoes a general treatment, such as incineration, landfilling or informal dumping. The mercury sources to waste are consumer products with intentional mercury content (batteries, thermometers, fluorescent tubes, etc.) as well as high volume waste like printed paper, plastic, etc., with small trace concentrations of mercury.

3.0 Data and Inventory on Energy Consumption and Fuel Production

3.1 Oil Extraction

Trinidad and Tobago is the largest producer of oil and natural gas in the Caribbean region. In the 1990's, the country's hydrocarbon sector became more natural gas dominant. Data for oil extraction was gathered from the Ministry of Energy and Energy Industries' consolidated bulletin for January to December 2015 (Government of Trinidad and Tobago. 2016). The values given were in barrels of oil (bbls) per day and a conversion was made into tonnes per year. The conversion was done utilizing the CME (Chicago Mercantile Exchange) Group Conversion Calculator. In the end, the annual consumption of 47,024,996 tonnes of crude oil for 2015 meant that from oil extraction the estimated input of mercury is 160 Kg Hg/y.

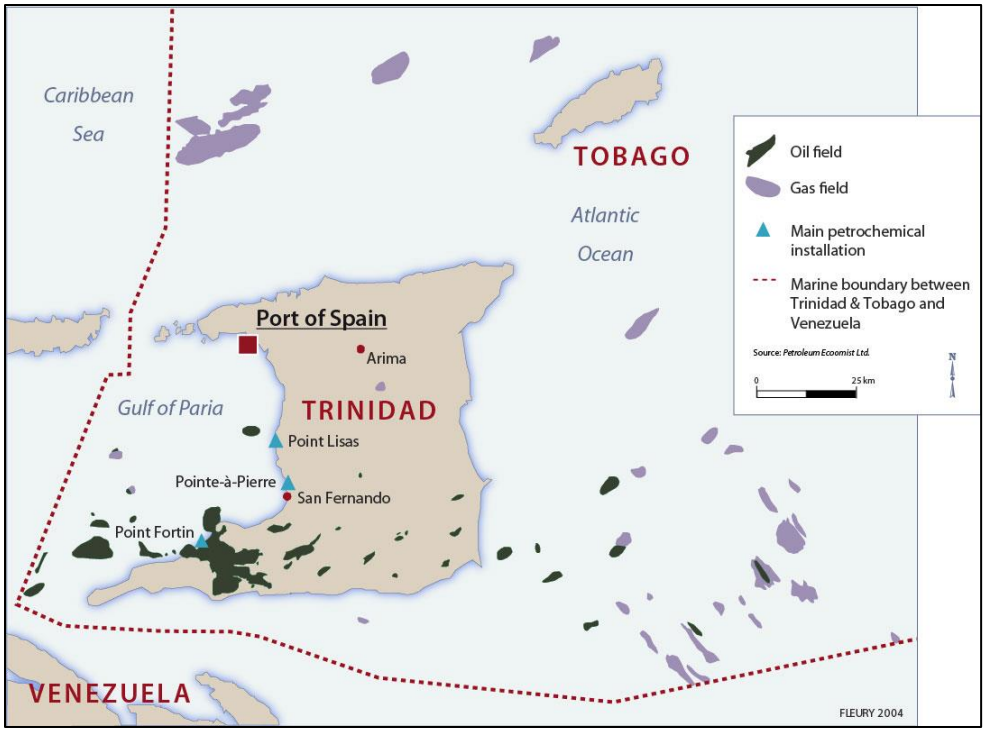

Figure 12: The Location of Oil and Gas Fields in Trinidad and Tobago (Caribbean Atlas, 2016)

3.2 Oil Refining

Trinidad and Tobago has one oil refinery; the state-owned Petroleum Company of Trinidad and Tobago (PETROTRIN), located in the south-west. It is responsible for producing 5,416,042 tonnes per year of refined crude oil which amounts to 18kg Hg/y.

PETROTRIN was contacted for information on their refinery processes and it was stated that the catalysts used in their processes were never tested for mercury as it was not shown to be present in any detectable or otherwise significant quantity in the crude oil that was being treated. They also indicated that the agency contracted to dispose of the catalysts did not report any mercury present in the catalysts.

NOTE: The CME Group Conversion Calculator was used to convert the amount of oil produced per year from bbls to tonnes per year.

3.3 Extraction and Processing of Natural Gas

The processing of natural gas is designed to clean the raw natural gas by separating impurities and various non-methane hydrocarbons and fluids. This produces the natural gas which is sent via pipelines to downstream entities. The process is shown in Figure 13.

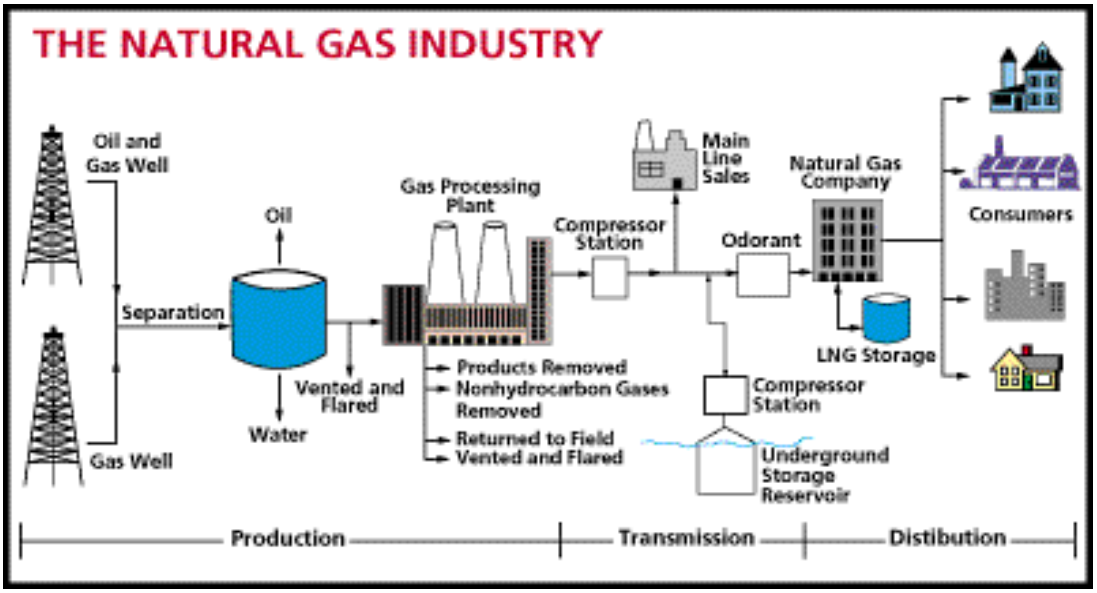

Figure 13: Extraction and processing of natural gas (DTE Energy Company 2016)

From information provided by the Ministry of Energy and Energy Industries, Trinidad and Tobago produced 1.3 billion normal cubic metres (Nm^3) of natural gas per year and this contributed to 130 Kg Hg/y.

The two main natural gas producers in the country are Phoenix Park Gas Processors Limited (PPGPL) and Atlantic LNG. The natural gas liquids complex (NGL) of PPGPL is one of the largest natural gas processing facilities in the western hemisphere (MEEI, 2016). Processed natural gas is transferred to the various petrochemical plants and power generation facilities in the country. It should be noted that Trinidad and Tobago's electricity is fuelled entirely by natural gas, which emphasises the importance of the resource to the country. One of the power generation plants in the country, Trinidad Generation Unlimited (TGU) produced 720 MW annually and they reported that they used 21,842,071 mcf of natural gas in 2015. They also reported that the purchased natural gas was not treated to remove mercury and they did not have any way of measuring mercury emissions. Both PPGPL and TGU failed to measure their mercury emissions.

Atlantic LNG, which is one of the world's largest suppliers of natural gas, did measure their mercury emissions. In all of their measurements, the mercury concentrations were very low and at times below a detectable limit. On assessing Atlantic's Certificate of Environmental Clearance, readings for mercury were taken through a 24 hour period where 0.1 $\mu g/m^3$ were produced. According to the country's Air Pollution Rules (2014), the permissible level is 1.5 $\mu g/m^3$ and therefore, Atlantic LNG was well within the range.

4.0 Data and Inventory on domestic production of metals and raw materials

Currently Trinidad and Tobago does not produce any metals domestically that would be expected to have potential mercury release sources. It must be noted that just prior to the commencement of this project, ArcelorMittal, a multinational organisation that manufactures steel, closed in March 2016 citing financial constraints.

4.1 Cement Production

The Trinidad Cement Limited (TCL) Group is a leading producer and marketer of cement and ready-mixed products in the Caribbean. In 2015, the TCL group recorded the highest revenue in its history of TT $2.1 billion despite the re-structuring of a number of departments.

The production of cement is done in Trinidad and Tobago and involves a number of steps. Limestone is excavated and crushed until it is fine enough for water, iron oxide and sand to be added to it to form "slurry". The slurry is then transported to the manufacturing plant where it is put into an oven. The heat transforms the slurry to "clinker" (large, glassy, red-hot cinders). The clinker is sent to a grinding ball mill for final grinding (TCL, 2014). The process is explained in Figure 14. It should be noted that Trinidad and Tobago produced 1,856 tonnes per year of cement in 2015.

Mercury is introduced to the cement production process through the raw materials and through the fuels used in the cement kiln. Mercury concentrations may vary greatly based on the type of raw materials, fuel and mercury contained within deposits or quarries.

It should be noted that in terms of the Mercury Inventory Toolkit used for the inventory, mercury emissions are calculated under the assumption that 50% of the cement is produced with co-incineration of waste and that basic particle filters are used. However, in the case of TCL cement production, there is no co-incineration of waste and the fuel type used for its kilns is solely natural gas as supplied by the National Gas Company of Trinidad and Tobago Limited. Natural gas is considered a relatively clean fuel with low mercury content as opposed to other types typically used in cement production.

The kiln exit gas stream is also "cleaned" using an electrostatic precipitator (rather than a particle filter) at each of TCL's two cement kilns. The electrostatic precipitator causes particles to agglomerate on the collector plates and periodically be dislodged by the rappers before being generally returned to the process.

Therefore, due to the differences discussed, it can be assumed that the mercury releases caused by cement production in Trinidad and Tobago may be significantly lower than estimated in this inventory. A Level 2 Inventory may better capture the estimates for this sector.

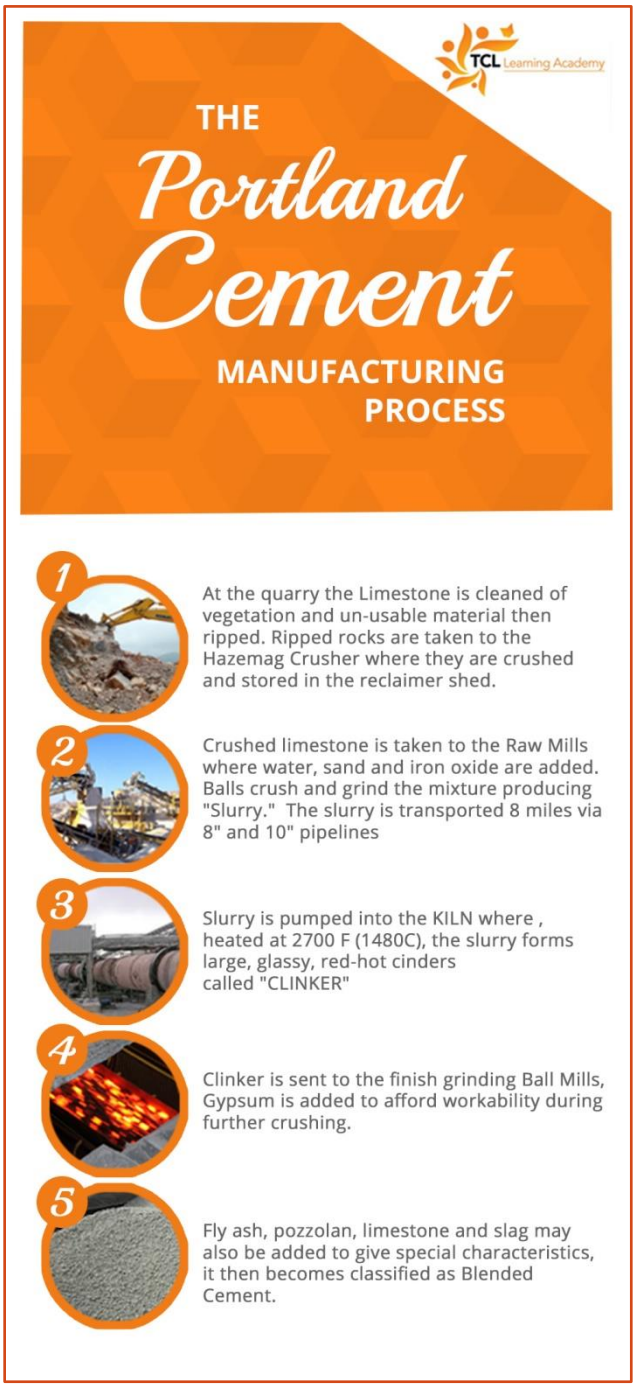

Figure 14: Outline of the cement manufacturing process (TCL, 2014)

5.0 DATA AND INVENTORY ON DOMESTIC PRODUCTION AND PROCESSING WITH INTENTIONAL MERCURY USE

Trinidad and Tobago does not produce any of these products. They are however imported. Further information on relevant products is provided in Section 7.0 of this report.

6.0 DATA AND INVENTORY ON WASTE HANDLING AND RECYCLING

The country's municipal waste is managed by the Municipal Corporations who then arrange for collection and transport of the waste to disposal sites. The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL) manages the three major landfills in Trinidad located at Beetham in Port-of-Spain, Forres Park in Claxton Bay and Guanapo in Arima, and one in Tobago at Studley Park. Figure 15 shows their relative locations.

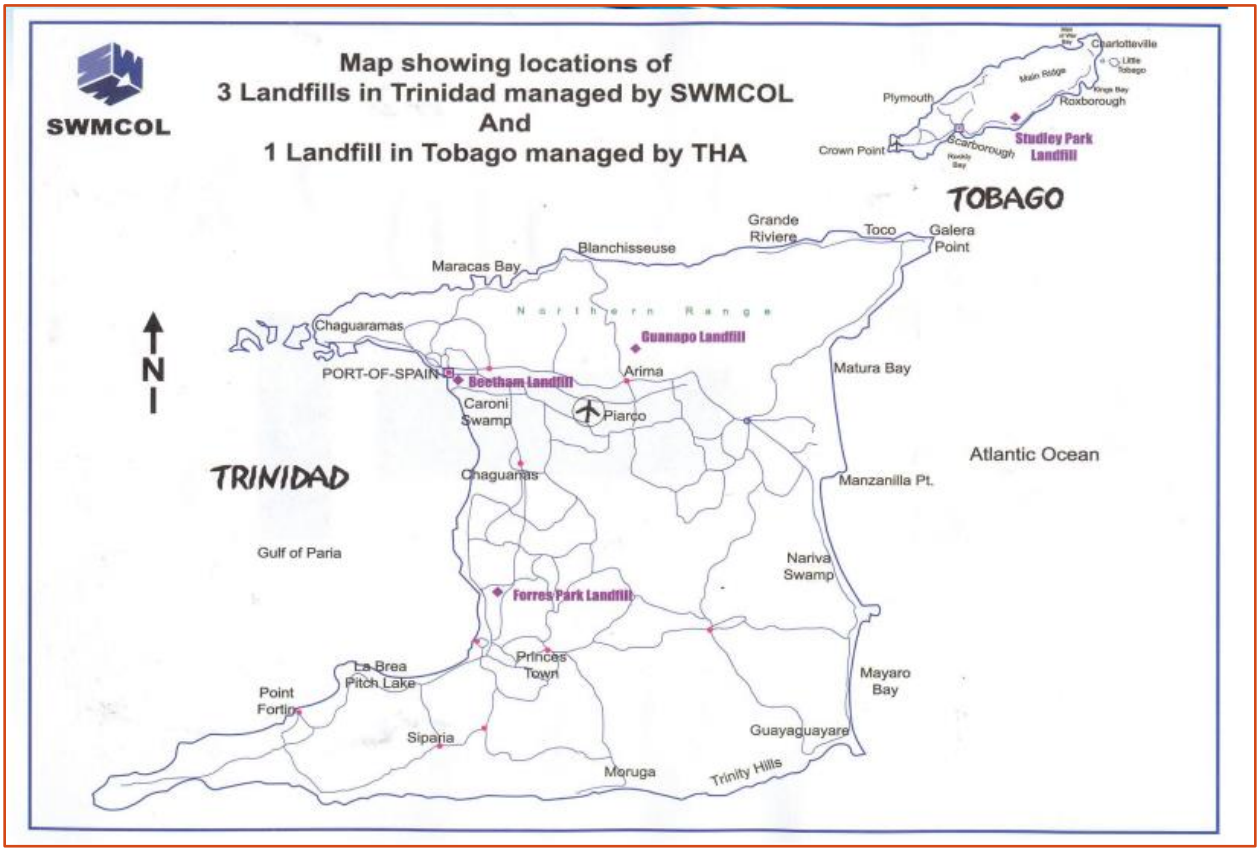

Figure 15: Map of Trinidad and Tobago highlighting the landfills (SWMCOL, date unknown)

These landfills are municipal solid waste landfills as they accept household waste as well as other "every day" waste. There is also the privately managed Guapo landfill site. The distributions of the types of waste that end up in each landfill are noted in Table 9.

Table 9: Components of Garbage at the Various Landfills (GoRTT, 2015)

Type of Waste	Beetham	Forres Park	Guanapo	Guapo
Organics	32.0%	22.4%	21.7%	10.5%
Paper	21.4%	13.7%	18.0%	18.7%
Glass	8.7%	11.6%	10.3%	23.0%
Metals	2.8%	4.0%	6.3%	3.5%
Plastics	16.0%	26.0%	19.1%	17.0%
Textiles	8.2%	7.8%	6.6%	8.6%
Beverage Containers	0.8%	1.3%	0.9%	0.6%
Other	1.8%	2.7%	5.2%	5.5fh%

According to the Waste Disposal Report (2007), Beetham is the largest site covering 61 hectares of Trinidad, while Guanapo is the smallest at just 7 hectares. Due to the site's location in a wetland and its close proximity to the capital city of Trinidad, this disposal site poses a threat to the environment. The site also has a bottle recovery facility and a faecal waste stabilization pond system. In 2013, SWMCOL carried out air quality testing at 3 different points of the Beetham landfill for an 8 hour period, the results of which are shown in Table 10 (GoRTT, 2015).

Table 10: Results of Air Quality Testing at Beetham Disposal Site, Trinidad, 2013 (GoRTT, 2015)

PARAMETER	**8-hour AVERAGE**		
	LOCATION #1	**LOCATION #2**	**LOCATION #3**
Hg ($\mu g/m^3$)	**<0.63**	**<0.58**	**<0.68**

Forres Park is the second largest landfill in the country and was developed using an engineering principle. It has a leachate collection system as well with groundwater monitoring wells being incorporated into its infrastructure (GoRTT, 2015).

Despite being the smallest site, the Guanapo landfill has the potential to have direct negative impacts on the surface water that is located downstream from the site. This landfill has a number of other physical constraints including close proximity to homes, the Guanapo River, a failing main access road and the presence of scavengers on the site.

The Studley Park Integrated Facility is operated by the Tobago House of Assembly and is the only official disposal site for Tobago, located 15 kilometres east of Scarborough. On-site are 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.

The total quantity of waste collected by the landfills in 2015 was 522,309 tonnes.

For the inventory, only a few sections on waste handling and recycling were applicable to Trinidad and Tobago and data (for example, for the section on “Incineration and open burning of medical waste”) could not be made available within the timeframe for the report.

7.0 Data and Inventory on General Consumption of Mercury in Products, as Metal Mercury and as Mercury Containing Substances

7.1 General Background Data

Table 11 indicates that the background calculations for the product groups listed below were based on the data on population, electrification rate and dental personnel density shown in Table 12.

Table 11: Data Types Used as Activity Rates for Sub-categories

Sub-category	Data types used as activity rates
Dental amalgam fillings ("silver" fillings)	Population, density of dental personnel
Electrical switches and relays with mercury	Population, electrification rate (percent of population with access to electricity)
Polyurethane (PU, PUR) produced with mercury catalyst	Population, electrification rate (percent of population with access to electricity)
Other manometers and gauges with mercury	Population, electrification rate (percent of population with access to electricity)
Laboratory chemicals	Population, electrification rate (percent of population with access to electricity)
Other laboratory equipment with mercury	Population, electrification rate (percent of population with access to electricity)

Table 12: Background Data for Default Calculations For Dental Amalgam And Certain Other Product Types.

BACKGROUND DATA NEEDED FOR DEFAULT CALCULATIONS AND RANGE TEST			
Compulsory: Click cell below and select country from list	Population in 2015	Dental personnel per 1000 inhabitants	Electrification rate, % of population with access to electricity
Trinidad and Tobago	1,349,667	0.084	99

The data in Table 12 are provided as part of the Toolkit. For most countries they are based on authoritative international data sources (population data: Central Statistics Office, Ministry of Planning and Development, Trinidad and Tobago; Dental data: WHO; Electrification data: IEA).

7.2 Dental Amalgam Fillings

Dental amalgam is a mixture of liquid mercury and metal alloy that is used to fill cavities caused by tooth decay. The country has over 200 registered dentists, with the majority pursuing their own private practice. A study by Paryag et al (2010) concluded that 48.8% of dentists disposed of amalgam waste in the trash, while 39.5% washed it down the sink, and furthermore, 37.2% categorised it as hazardous waste. The study found that a total concentration of 3.4 grams per day per dentist was released into the environment. This project was supported by the two recognised associations in the country; the Trinidad and Tobago Dental Association and the Dental Council of Trinidad and Tobago.

This inventory found that dental amalgam fillings provided a mercury input of 27 kg Hg/y. The majority of dentists used pre-capsulated mercury in their practice (Figure 16), which all came from the same supplier. Most of the dentists indicated that reusable chair side trap filters were used but the waste from the filters were disposed of in the general garbage. There appears to be a trend that a number of dentists are in the process of moving away from using dental amalgam. One dentist confirmed that they did not use amalgam at all as it is considered to be an outdated practice; while another stated that the amalgam waste was stored in a container under a layer of water. It should be noted however, that according to the Dental Council of Trinidad and Tobago, there are a number of unregistered dentists operating in the country from which data could not be obtained.

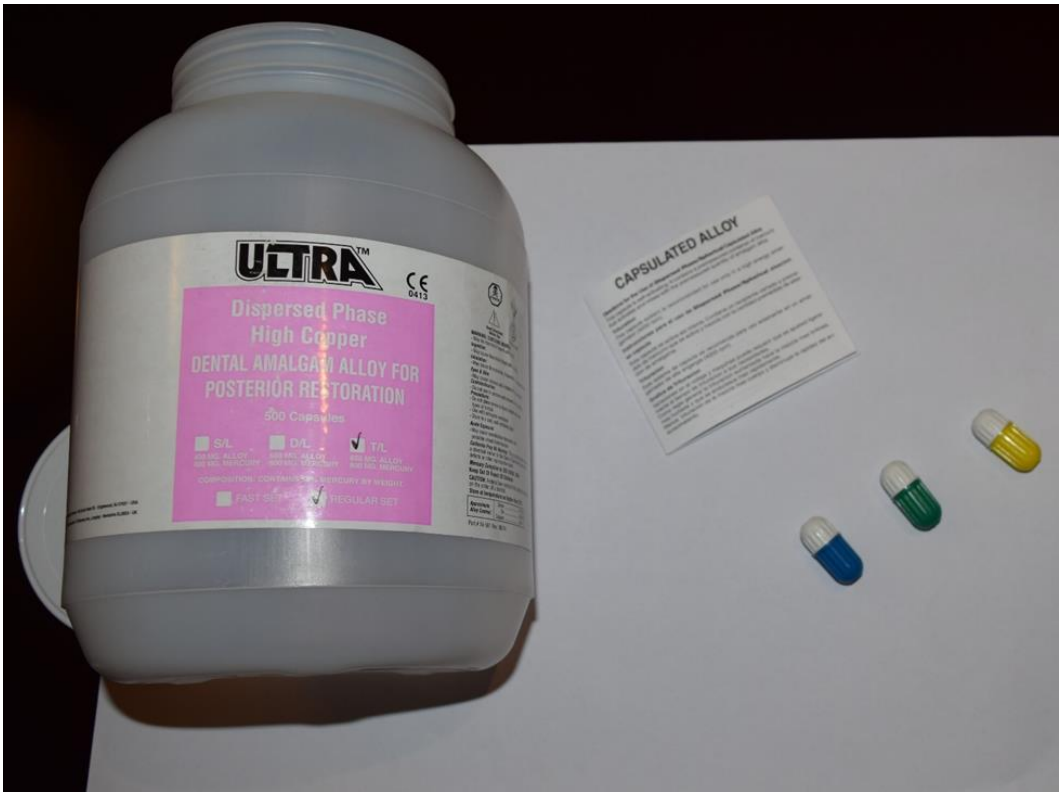

Figure 16: Container of Dental Amalgam Alloy (Photo taken by BCRC-Caribbean, 2016)

According to UNEP (2016), mercury pollution from dental amalgam may occur during:

- Production of amalgam capsules;
- Preparation, placement and removal of dental restorations;
- Discharge of dental amalgam residues into wastewater (e.g. at the dental clinic or via normal human waste at home);
- Disposal of amalgam into solid, medical or hazardous wastes or otherwise;
- Disposal or land application of municipal sewage sludge that is contaminated with mercury from amalgam;
- Release from amalgam fillings in the deceased who are buried, or more so, when the remains are cremated.

Mercury wastes and releases generated by dentistry are difficult to monitor and control due to the various pathways by which they may be released. Approximately two-thirds of dental mercury is

eventually released to the environment. Figure 17 further illustrates the pathways by which mercury is released to the environment.

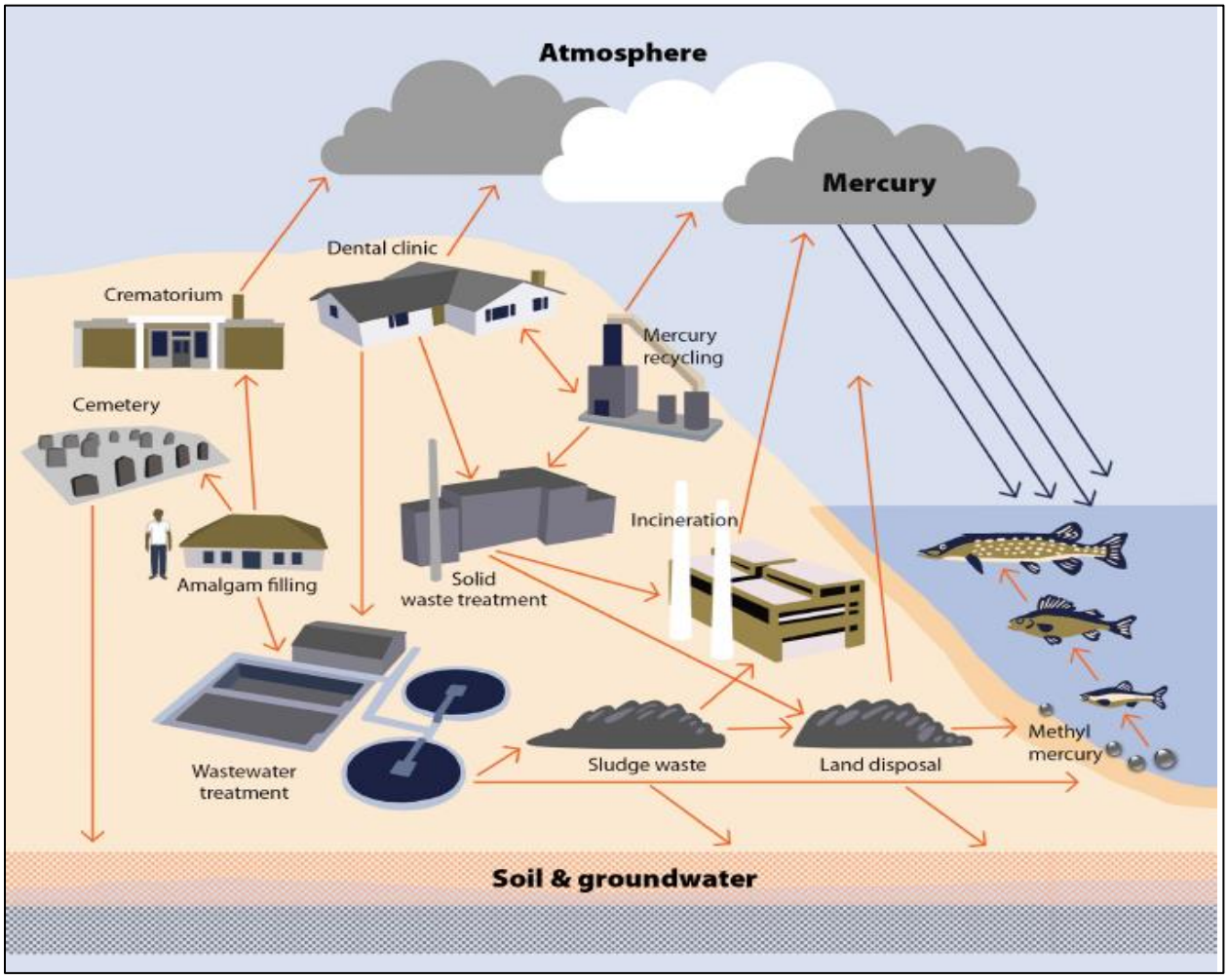

Figure 17: Mercury releases to the environment from dental care SOURCE: Concorde 2007 (UNEP 2016)

There are two main approaches to reduce mercury from dentistry. The first approach is the pollution management approach which aims to reduce the environmental impact of mercury releases by using appropriate waste management measures, amalgam preparation procedures and air treatment systems. The second approach involves reduction measures by implementing appropriate polices to reduce the use of mercury in society. Both these measures need to be implemented together in order to effectively reduce environmental impacts.

There are numerous measures that countries can implements to limit dental amalgam mercury releases to the environment. One way is to create an accurate inventory of amalgam use to estimate the quantity of mercury being used by the dental sector. This may be done by:

• Requesting or requiring amalgam manufacturers, distributors and/or importers to supply data;

• Examining the country's amalgam supply-demand chain and costs;

• Assessing the number of dentists in the country and determining average amalgam use; or

• Tracking imports of encapsulated dental amalgam and elemental mercury imported for use in dental restorations.

7.3 Light Sources of Mercury

7.3.1 Outdoor Sign Lamps (that use argon gas)

Mercury is used in outdoor sign lamps for advertising. A sign manufacturer in the country was found to have imported a net weight total of 15 kg of mercury (including the weight of the container) in 2011 and when contacted, indicated that mercury was used in the process in very miniscule amounts. The manufacturer stated that less than 0.5 mL (1 drop) is added to an argon lamp when it is made so a 300 mL bottle of mercury that was imported lasts for years. The lamp glass is then fused closed and activated with electricity. This causes the mercury to be rolled along the inside of the lamp which results in a brighter colour being emitted.

The usage of mercury depends on the type of gas that is used to fill the lamp; the different gas types are neon and argon. Mercury is only required if argon gas is used in the lamp tubes since argon lights become blue when charged with electricity and mercury must then be added in order for the argon lights to become bright (Edison Tech Centre, 2013). In the industry, there is about a 50/50 spilt between the gases.

7.3.2 Light houses (levelling bearings in marine navigation lights)

It has been found that some lighthouses that have large Fresnel lenses use mercury baths as a low-friction rotation mechanism in their function (van Netten and Teschke, 1988). Upon discussions with the Maritime Division of the Ministry of Works and Transport, it was indicated that at least 2 lighthouses in the country used mercury baths. They are located respectively at Fort George and the Chacachacare island on the east side of the Dragon's Mouth strait, off the north-western tip of Trinidad. It is approximated that 2-4 kg of liquid Hg are present in each of the baths which would require careful handling to ensure environmentally sound storage and disposal.

7.4 Fluorescent Bulbs

Fluorescent lamps or fluorescent tubes use mercury to generate light. The process begins when 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. These are considered hazardous waste by the United States Environmental Protection Agency and it is recommended that they be separated from household waste as they can be broken during handling which allows mercury to enter into the environment. Despite containing mercury, these bulbs are commonly used because of their energy efficiency which in turn lowers the demand for power by the population.

In Trinidad and Tobago 1,919,617 fluorescent lamps were imported in 2015 alone. Over the period of January 2011 to August 2016, 8,208,346 fluorescent bulbs were imported into the country. Such a large number would result in high amounts of mercury entering the environment when these bulbs are eventually disposed of.

7.5 Thermometers

Pharmaceutical companies are the main importers of thermometers into the country. Traditionally thermometers contain mercury however, more companies are importing digital thermometers which do not rely on the rising of mercury. Digital thermometers contain a thermos-resistor; a sensor that changes it resistance with temperature change. This resistance is detected by a circuit and it is converted to temperature.

8.0 DATA INVENTORY ON CREMATORIA AND CEMETERIES

According to the Central Statistical Office in Trinidad, for 2015 the mid-year death estimate was 11,576 persons.

In Trinidad and Tobago, funeral arrangements consist of burials, cremations and open burning. According to a 2011 census, approximately 18% of the population is Hindu. The most common traditional final rights method practiced amongst the Hindu population in Trinidad is open burning on funeral pyres at designated sites throughout the country. The emissions from this practice are directly released into the atmosphere.

Based on data received from the questionnaires sent out to funeral homes, there appears to be a trend developing in preference of cremation rather than burial possibly due to cremations being relatively cheaper. In addition, cremations provide the option of keeping the body in a separate container instead of a casket.

When burning humans or other animals, there are toxic emissions associated with the process. These are:

• Any mercury amalgam dental fillings which haven't been removed;

• Organohalogens (dioxins, furans, etc.) and other toxics accumulated through diet and other exposures;

• Any plutonium pacemakers which haven't been removed;

• Silicone breast implants, which can contain PVC, Methylene Chloride and other toxic chemicals;

• Other metal or plastic implants in humans;

• Radioactive or toxic tracers or testing chemicals from animal experimentation (for animal carcass incinerators);

• Metal or plastic implants of tracking chips in pets (for pet crematoria).

Cemeteries are low-risk sites, as there is less potential for mercury in the bodies (as amalgam etc.) to be chemically mobilized. There is greater risk however, of mercury being released in the atmosphere at the crematoria if corpses have dental amalgam filling still intact.

8.1 Crematoria

The value entered into the toolkit for crematoria was 7,134. This was an estimated value that was obtained by utilizing the mid-year death total and the values obtained from the questionnaires. The response rate was low again, around 40% which lead to an extrapolated value being used.

8.2 Cemeteries

The value 4,442 used in the toolkit was an extrapolated value as well. It was obtained similarly to the value for the crematoria; by utilizing the mid-year death total and the values obtained from the questionnaires.

9.0 Storage and Disposal Options

Mercury wastes must be stored in an environmentally sound manner in order to avoid contamination and should be done in compliance with the requirements stipulated by the relevant law(s) where applicable.

The criteria for siting and designing a storage facility are very clear according to UNEP/ISWA (2015). Mercury storage sites should not be built in locations that are considered sensitive, such as natural disaster risk areas like floodplains and earthquake zones. Also, the floors of the structure should be covered with some type of mercury-resistant material such as, epoxy-coated cement, polyurethane coated floors, seamless rubber floors, or polyester flooring. The temperature of the building should be constantly low and the area well ventilated. Warning signs should be clearly marked indicating among others:

- Toxicity/ Hazardous
- Type of mercury waste
- Origin
- Weight
- Shock Resistance

The criteria that exist for the general operation and safety in the facility include storage requirements where for instance, mercury wastes must not be stored with other wastes; there must be regular monitoring, restricted access, training and awareness of staff, fire alarms and suppression systems and; an emergency plan.

Disposal operations differ from storage as they do not allow for the resource to be recovered, reclaimed or recycled. Recovery options do exist and they are addressed in the Basel Technical Guidelines and the Minamata Convention on Mercury as an inherent part of disposal. If mercury is recovered with the intent of re-use, it is referred to as a recovery operation, whereas, if it is extracted for the purpose of subsequent disposal, it is referred to as a physico-chemical treatment (UNEP/ISWA, 2015).

Physico-chemical treatment is a disposal option where mercury can be stabilized chemically or solidified using commercially available technologies. These technologies may include micro-encapsulation which involves mixing the waste with an encasing material (such as a sulphur polymer) or macro-encapsulation which involves pouring the encasing material over and around the waste mass, enclosing it in a solid block (UNEP/ISWA, 2015).

Another option for disposal of mercury is to design a Specially Engineered Landfill (SEL) where solid wastes are capped and isolated from each other and from the environment (UNEP/ISWA,

2015). One major concern with SELs is that the mercury may lead to the leaching of contaminants since it is not yet proven that the treatment used can stabilize mercury effectively.

The final disposal option for mercury waste is the permanent storage of mercury in underground facilities such as in underground mines. This intends to isolate the mercury wastes permanently from the biosphere using a suitable host rock such as salt rock, clay formations or hard rock formations, via several natural and artificial barriers such as salt, clay or bunter stone and waste packaging, brick walls, field dams or watertight shaft sealings (UNEP/ISWA, 2015).

The specific recommendations for the storage of mercury are discussed *Section 12.0: Recommendations.*

10.0 LEGISLATION

The text of the Minamata Convention on Mercury (hereinafter called "the Convention") was adopted by the Conference of the Plenipotentiaries on October 10, 2013 with its main objective being to protect human health and the environment from emissions and releases of mercury and mercury compounds due to human activities (UNEP, 2013). This was done after mercury was recognized as a substance that has the capacity to have significant adverse neurological effects.

The pieces of primary and secondary legislation in Trinidad and Tobago related to the management of mercury included:

- Pesticides and Toxic Chemicals Act and Regulations Chap. 30:03 which include:
    - Toxic Chemicals Regulations, 2007
- The Environmental Management Act Chap. 35:05, which include:
    - Certificate of Environmental Clearance Rules, 2001 and its Order, Certificate of Environmental Clearance CEC (Designated Activities) Order 2001 (as amended 2007, 2008
    - Water Pollution Rules 2001 (as amended 2006)
    - Air Pollution Rules, 2014
    - Draft Waste Management (Hazardous Waste) Rules, 2014
- The Occupational Safety and Health Act Chap. 88:08
- Customs Act, Chap. 78:01
- Food and Drugs Act, Chap. 30:01

The articles of the Convention were used to determine the local legislation that needed to be reviewed. The relevant articles, Articles 3 to 16, were weighed against existing legislation to determine its sufficiency with consideration to the entire life cycle of the mercury process was considered. This ranged from source separation, trade, collection, storage to disposal. The review found that the provisions of the articles did not necessarily fit squarely into the framework provided by local legislation. This therefore suggests some inadequacy of local legislation to treat with all the issues envisioned by the drafters of the Convention. The articles and corresponding legislation will be considered in turn. It should be noted that of the 35 Articles of the Convention, only those relevant to the inventory, storage and disposal were highlighted as follows.

Article 3 - Mercury Supply Sources and Trade

This article deals with mercury supply sources and trade. It not only defines mercury and its compounds but establishes the requirements of Parties as it relates to sourcing mercury, disposing of it and its trade. The provisions dealing with mining are irrelevant to Trinidad and Tobago as that activity does not take place locally. The relevant piece of local legislation that governs the disposal, import and export of chemicals of this type would be the **Pesticides and Toxic Chemicals Act Chap. 30:03**. Section 4A (1) (d) of that Act prohibits the import, export and disposal *inter alia* of a "controlled chemical" without doing so in a prescribed manner. Section 45 of the **Customs Act, Chap. 78:01** also deals with the prohibition of goods to be imported and can be amended to include mercury containing products**. Toxic Chemicals Regulations, 2007** under the Act also specifically address the issue of storage conditions, transport, use in manufacturing and adequate disposal. The Act should be amended to take into consideration the provisions of this Article.

Article 4 – Mercury-added Products

This article prevents Parties from the manufacture, import or export of mercury-added products listed in Part I of Annex A of the Convention and as such this would also be governed by the **Toxic Chemicals Regulations, 2007** once the mercury-added product satisfies the definition of a toxic chemical as outlined in the regulations. Section 14 of the **Food and Drugs Act, Chap. 30:01** deals specifically with the prohibition of sale of harmful or unsanitary cosmetics which could also be applied to mercury-containing cosmetic products like skin lightening creams.

Article 5 – Manufacturing Processes in which mercury or mercury compounds are used

This article prohibits the use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B of the Convention except where the party has a registered exemption pursuant to Article 6. It also requires that Parties take measures to restrict the use of mercury or its compounds in the processes listed in Part II of Annex B of the Convention. Such activity is also governed by Section 4A of the **Pesticides and Toxic Chemicals Act Chap. 30:03** and the **Toxic Chemicals Regulations, 2007**.

Article 8 – Emissions

This article requires Parties to control and where feasible reduce emissions of mercury and mercury compounds from the point sources falling within the source categories listed in Annex D of the Convention. The requirements of this article can be governed by the **Air Pollution Rules, 2013** made pursuant to Section 49(2) of the **Environmental Management Act Chap. 35:05**. It should be noted that the definitions of this section can also be incorporated into this section by amendment.

Article 9 – Releases

This article requires Parties to control and where feasible, reduce releases of mercury and mercury compounds to land and water from the relevant point sources not addressed in other articles in the Convention. The article goes on to provide other relevant definitions with which it must be read. This activity falls within the ambit of the **Water Pollution (Amendment) Rules, 2006** which deals with the prohibition of pollutants into water. Sections 59 and 60 of the **Environmental Management Act Chap. 35:05** incorporate hazardous substances and spills as they refer to performance standards and procedures for the safe handling as well as prohibition of such substances. Sections 55-58 of the Act refer to wastes, in terms of, management, identification of hazardous wastes, waste permits and licences and waste prohibitions. Therefore Sections 55-60 of the **Environmental Management Act Chap. 35:05** could provide for releases of mercury and its compounds to land while the **Water Pollution (Amendment) Rules, 2006** could provide for releases of mercury and its compounds to water.

Article 10 – Environmentally Sound interim Storage of Mercury other than Waste Mercury

This articles deals with the interim storage in an environmentally sound manner of mercury and mercury compounds. The **Pesticides and Toxic Chemicals Act Chap. 30:03** may also provide for this activity under its Section 4A and more specifically within the **Toxic Chemicals Regulations, 2007**. These would have to be amended to clarify the conditions for environmentally sound management. It should also be noted that the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal to which Trinidad and Tobago is a signatory, defines "environmentally sound manner" in its Article 2, allowing for this to be incorporated into local legislation. The **Certificate of Environmental Clearance (Designated Activities) (Amendment) Order, 2008** would also be relevant to Article 10 as Designated Activity 36 states that a Certificate of Environmental Clearance is required for the establishment of a facility for hazardous or toxic substance handling.

Article 11 – Mercury Wastes

This article deals with mercury waste generally. The Basel Convention and the proposed **Draft Waste Management (Hazardous Waste) Rules, 2014** govern this activity.

Article 12 – Contaminated Sites

This article treats with the requirement by Parties to develop appropriate strategies to identify and assess sites contaminated by mercury or its compounds. Section 61(3) of the **Environmental Management Act Chap.35:05** deals with the procedure required in the event of spills, releases and other incidents related to hazardous substances. More specifically, a Certificate of Environmental Clearance as required under the **Certificate of Environmental Clearance Rules, 2001** would also state a condition for emergency responses required based on the operations of

the facility which in this case would be a facility that handles mercury and mercury containing wastes.

Article 16 – Health Aspects

This article encourages Parties to promote strategies, programmes and services in relation to the regulation of exposure to mercury and mercury compounds. It also makes specific reference to occupational exposure. This could be treated with under the **Occupational Safety and Health Act Chap. 88:08.** Part IV of that Act which 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 subsections 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 can be encompassed.

It is clear from the information presented that the existing local legislation can to some extent treat with the provisions of the Convention. However in many cases, Regulations and subsidiary legislation would need to be amended in order to provide for mercury and its compounds specifically. The line Ministry (the Ministry of Planning and Development for the Environmental Management Act Chap. 35:05; the Ministry of Labour for the Occupational Safety and Health Act Chap. 88:08; and the Ministry of Health for the Pesticides and Toxic Chemicals Act Chap. 30:03; the Ministry of Finance for the Customs Act, Chapter 78:01) is required to take the requisite Note to the Cabinet to have the relevant piece of legislation approved for amendment. If approval is granted, the relevant instructions for amendment of the legislation would be given to the Legislative Drafting Department under the Ministry of the Attorney General and Legal Affairs.

11.0 CONCLUSION

The Minamata Convention has not yet been ratified but steps are being taken by Trinidad and Tobago to determine the merits of accession. The country's mercury emissions have not been monitored in some cases but from the preliminary findings of this inventory, mercury emissions can potentially have a notable impact on worldwide emissions.

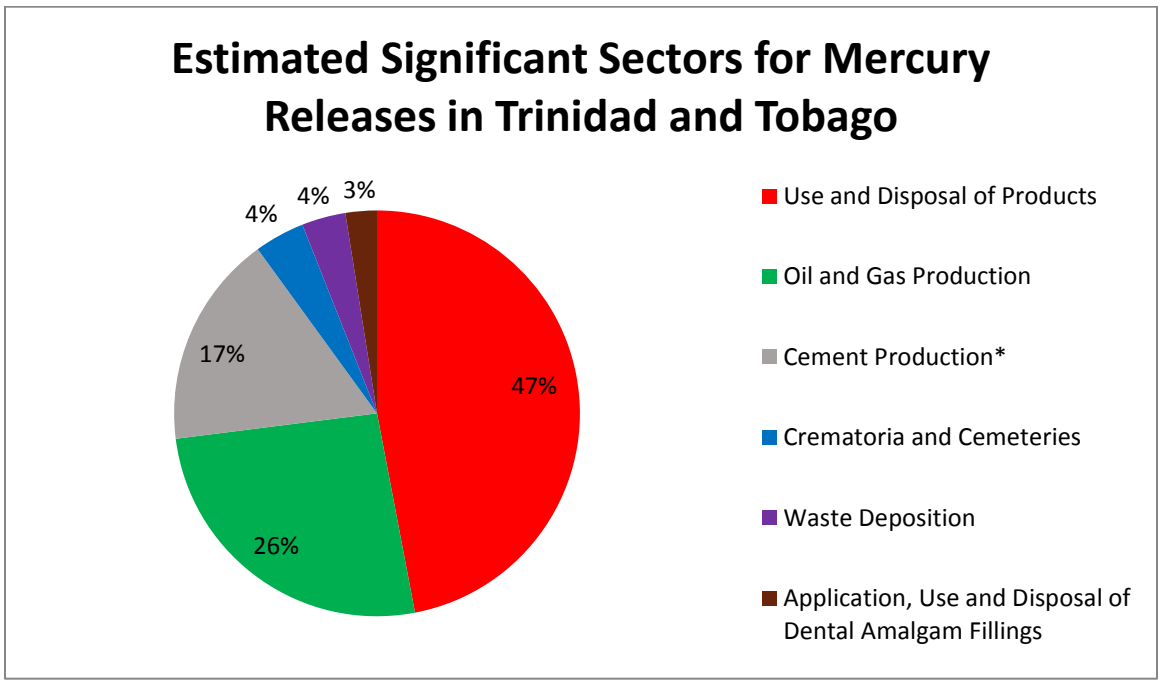

Figure 18: Pie Chart showing Significant Sectors for Mercury Releases in Trinidad and Tobago

As Figure 18 indicates, 47% of mercury releases, the highest source of mercury in Trinidad and Tobago based on the data gathered came from the use and disposal of products such as thermometers, fluorescent light bulbs, mercury-containing medical devices and laboratory chemicals with approximately 309 kg of mercury being released per year. The oil and gas production sector is the second highest contributor of mercury releases into the environment with 26% or 170 kg of mercury per year. Cement production was estimated as being the third largest contributor to mercury releases based on assumptions in the Toolkit but upon further discussions on the operations at the national cement production company, the actual emissions due to this sector may be significantly lower.

Crematories and cemeteries are responsible for approximately 29 kg of mercury per year being released in-country which is roughly 4% of total mercury releases.

From waste deposition in landfills, 2,611 kg of mercury per year are collected but this only contributes to 4% of total emissions for the country when refined to exclude the disposal of products and dental amalgam already accounted for in other sectors. It was also estimated that 21 kg of mercury per year were also estimated as being released due to the application, use and disposal of dental amalgam fillings.

In order to accede to the Convention, reviewing of the regulatory framework relating to mercury and mercury containing compounds is necessary. The pieces of legislation to be looked at include:

- Pesticides and Toxic Chemicals Act and Regulations Chap. 30:03 which include:
    - Toxic Chemicals Regulations, 2007
- The Environmental Management Act Chap. 35:05, which include:
    - Certificate of Environmental Clearance Rules, 2001 and its Order, *Certificate of Environmental Clearance (Designated Activities) (Amendment) Order, 2008*
    - Water Pollution (Amendment) Rules, 2006
    - Air Pollution Rules, 2013
    - Draft Waste Management (Hazardous Waste) Rules, 2014
- The Occupational Safety and Health Act Chap. 88:08
- Customs Act, Chap. 78:01
- Food and Drugs Act, Chap. 30:01

Only after such amendments have taken place can Trinidad and Tobago successfully implement and comply with the provisions of the Minamata Convention as they will be consistent with local legislation. It should be noted that the time dedicated to obtaining the data for this project was approximately three (3) months resulting in an inventory that was incomplete. As a direct result, Trinidad and Tobago cannot commit to any policy directives at this time. Additionally, this high level of decision making must be approved under the auspices of Cabinet.

Fortuitously, Trinidad and Tobago is part of the more detailed Minamata Initial Assessment Project which will utilise the Inventory Level 2 and be conducted over a two (2) year period. It is anticipated that an informed decision can then be made once a thorough inventory is complete.

12.0 RECOMMENDATIONS

This report has highlighted the use and disposal of mercury products as the main contributor to mercury releases in Trinidad and Tobago. Legislation regarding the proper disposal of mercury and other waste streams must be developed and enforced. Collaboration amongst the main environmental agencies, waste management organisations and education institutions to set up public awareness campaigns and collection centres or collection/exchange drives for personal mercury containing products such as thermometers and fluorescent bulbs can be effective measures to removing these products from homes and ensuring that they are managed in an environmentally sound manner as authorities can then accumulate mercury with the intent to conduct either recycling, reclamation or recovery. The possibility of using centralized box crushers for fluorescent bulb disposal as an intermediate means of reducing mercury releases to landfill from this commodity and concentrating any Hg liquids should be explored. With respect to the importation and use of fluorescent bulbs, the option of setting a reduced tariff level on bulbs containing low or no mercury in them is recommended.

In addition, in some cases substitute products could be used as opposed to those that contain mercury. These would include mercury-free digital thermometers, LED (light emitting diode) lights and dental amalgam substitutes like ceramic, porcelain, gallium, cold silver and glass isomers. In the case of dental amalgam, many dentists in Trinidad and Tobago have consciously shifted towards other mercury-free alternatives based on patient demands for more aesthetic restorations (Paryag et al, 2010). However, it is important to note that many of these mercury products are used due to their low cost in comparison to their mercury-free counterparts. Considerations should be given to reducing the duties placed on these mercury-free alternatives to make them more economically feasible options. Collaboration with the Ministry of Health can ensure that the public are made aware of the direct health implications caused by mercury containing products such as skin lightening creams.

Consultations with the Pesticides and Toxic Chemicals Control Board should be held in order to strengthen the regulations on imports of mercury containing products. Regulations should be drafted to encompass the issues posed by mercury releases in the country. Existing legislation should also be strengthened. For example, the **Pesticides and Toxic Chemicals Act Chap. 30:03** Section 4(A) which prohibits the import, export and disposal *inter alia* of a "controlled chemical" without doing so in a prescribed manner, is a significant section in regards to the environmentally sound management of mercury, including its disposal, and regulations could be drafted to enforce the provisions of this section. While the monitoring of imports of mercury and mercury products has been improved since February 2016 due to the Single Entry Window system launched by the Ministry of Trade, imports before that date may have not been efficiently tracked. There should be more rigid structures enforced to monitor imports. Amendments to Part VII of the **Toxic Chemicals Regulations, 2007** to include conditions to be placed on importers of mercury products should be made and regulations should be developed to ensure that these

conditions are enforced. Measures should also be developed to ensure that the relevant legislation is consistently enforced. This may be in the form of an Environmental Police Unit for law enforcement.

The oil and gas production sector was found to be the second largest contributor to the country's mercury releases. Measures should be taken to reduce these mercury emissions since this industry is so prominent in the country however, this is not expected to be curtailed in the foreseeable future. It is recommended that "end of pipe" techniques be utilized to contain the emissions of mercury. "End of pipe" refers to control methods at the point of emission so that the pollutant is hindered. They can be applied to a stream of air, wastewater, water, and their implementation occurs just before disposal or delivery. An end-of-pipe-technique like exhaust gas filtration is deemed appropriate for raw materials that contain trace amounts of mercury can also be used in natural gas-powered plants. Companies within the oil and gas sector should be strongly urged to regularly test their catalysts that may contain mercury so that accurate data can be obtained.

With respect to cement production, it is recommended that a follow-up is done to account for the type of fuel, cleaning methods and raw materials used in the process on a national level.

In Trinidad and Tobago, the best options for storage and disposal are:

1) To develop a facility (or facilities) for interim storage of mercury waste, the location of which will need to be determined in further discussions with relevant stakeholders. A consolidation of mercury waste produced by individual companies would be done by the companies themselves who would have to develop infrastructure "in-house" to arrange for the environmentally sound collection and transport of the waste to the interim storage facility. The interim storage sites would be developed in collaboration with the main waste management companies, including SWMCOL, as a sanitary engineered landfill under an integrated waste management approach, meaning that the facility would be equipped to handle mercury wastes as well as other hazardous wastes.
2) To have stabilisation/ solidification processes done at the interim storage facilities for the mercury waste. The recommended process would be solidification via cementation where the mercury waste would be encased in a solid block.
3) To export the waste at a national level for environmentally sound disposal to a processing facility where environmentally sound mechanisms exist for the proper extraction and disposal of mercury, for example in countries like the United States of America, Canada, Spain and the Netherlands. The exportation of solidified waste may be expensive due to the potentially large mass of the solid blocks so considerations would need to be made as to how these costs could be off-set.

An opportunity for accessing funds to offset the financial requirements of the storage and disposal options suggested for Trinidad and Tobago would be the upcoming seventh

replenishment of the Global Environment Facility Trust Fund (GEF-7) for the period 2018-2022. It is therefore recommended that the Government of the Republic of Trinidad and Tobago ratify the Minamata Convention on Mercury before this period in order to better make use of this potential opportunity.

It was also noted that based on the low response rate to questionnaires disseminated for data collection in this inventory, a follow-up survey with stakeholders is recommended.

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ANNEX 1

Questionnaire Templates

QUESTIONNAIRE FOR OIL AND GAS SECTOR

MERCURY STORAGE AND DISPOSAL PROJECT

COMPANY NAME			
MAILING ADDRESS (NUMBER, STREET, VILLAGE/CITY)/P.O. Box No.			
CEO/VICE PRESIDENT/DIRECTOR			
COMPANY CONTACT	Name (first,last):		
	Official Position:		
	Mailing Address (number, street, village/city)/ P.O. Box No.:		
	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:

FUEL PRODUCTION			
	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)**
2011			
2012			

2013			
2014			
2015			

4. Please provide any information on 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 AMMONIA AND METHANOL SECTOR

MERCURY STORAGE AND DISPOSAL PROJECT

COMPANY NAME			
MAILING ADDRESS (NUMBER, STREET, VILLAGE/CITY)/P.O. Box No.			
CEO/VICE PRESIDENT/DIRECTOR			
COMPANY CONTACT	Name (first,last):		
	Official Position:		
	Mailing Address (number, street, village/city)/ P.O. Box No.:		
	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:

	Processing of Natural Gas
Years	**(Nm^3/y)**
2011	
2012	
2013	
2014	
2015	

2. Does the facility consume treated (to remove trace mercury) natural gas or does it treat incoming natural gas to remove trace mercury at the plant?

3. If there isan operating mercury treatment process at the plant, describe this treatment system to address mercury in feed natural gas?

4. Does the facility currently use a non-regenerative sorbent system to remove mercury? If yes describe how the system operates.

5. Does this non- generative sorbent system generate liquid or solid wastes? If yes describe the types of wastes, annual amounts generated and how they are disposed.

6. Does the facility use regenerative adsorbents to remove mercury? If yes describe that process.

7. If regenerative adsorbents are used, do they generate liquid or solid wastes? If yes describe the waste types, the annual amounts of wastes and howeach waste is disposed of.

8. Mercury Management Programme

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.

9. **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

MERCURY STORAGE AND DISPOSAL PROJECT

COMPANY NAME			
MAILING ADDRESS (NUMBER, STREET, VILLAGE/CITY)/P.O. Box No.			
CEO/VICE PRESIDENT/DIRECTOR			
COMPANY CONTACT	Name (first,last):		
	Official Position:		
	Mailing Address (number, street, village/city)/ P.O. Box No.:		
	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:

	Processing of Natural Gas
Years	**(Nm^3/y)**
2011	
2012	
2013	
2014	
2015	

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. Mercury Management Programme:

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 MERCURY AND MERCURY CONTAINING DEVICES

MERCURY STORAGE AND DISPOSAL PROJECT

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

	Do You Import 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)				

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 BAUXITE AND CEMENT SECTOR

MERCURY STORAGE AND DISPOSAL PROJECT

NAME			
COMPANY NAME			
ADDRESS			
CONTACT INFORMATION	PHONE	MOBILE	EMAIL

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

	Primary Metal Production	**Other Materials production**
Years	**Alumina Production from bauxite [aluminium production]** **(Bauxite processed, t/y)**	**Cement Production** **(tonnes of cement produced, t/y)**
2011		
2012		
2013		
2014		
2015		

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

3. Do your scrubbers contain mercury?

4. If 'YES' to #3 above, please describe the disposal process.

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

MERCURY STORAGE AND DISPOSAL 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	**Old Amalgams Removed**	**New Amalgams Placed**
2015		

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)

_____

_____

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 WASTE

MERCURY STORAGE AND DISPOSAL PROJECT

NAME			
COMPANY NAME			
ADDRESS			
CONTACT INFORMATION	PHONE	MOBILE	EMAIL

1. Kindly fill in the following information where applicable:

WASTE INCINERATION					
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)**
2011					
2012					
2013					
2014					
2015					

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 FUNERAL HOMES

MERCURY STORAGE AND DISPOSAL 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**
2011		
2012		
2013		
2014		
2015		

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

Thank you for taking the time to complete this survey

ANNEX 2

Completed National Mercury Inventory Level 1 UNEP Toolkit for Identification and Quantification of Mercury Releases

Trinidad and Tobago Mercury Releases Inventory Level 1 UNEP Toolkit for Identification and Quantification of Mercury Releases

(Microsoft Excel Spreadsheet)

Available at:

https://www.dropbox.com/s/fvtg9ohsenxb4wy/Trinidad%20and%20Tobago%20Hg%20Inventory%20Toolkit%20Level%201.xlsx?dl=0

ANNEX 3

National Action Plan

Prepared at the Inception Workshop, Hilton Hotel, August 13, 2015- Final Amendment- December 14, 2016

WORKPLAN FOR THE IMPLEMENTATION OF THE MERCURY STORAGE AND DISPOSAL PROJECT IN TRINIDAD & TOBAGO

GENERAL OBJECTIVE : To create a framework for ESM of Hg storage and disposal for T&T

OUTPUT/ACTIVITIES	TASKS	RESPONSIBLE	PARTNERS	TIMEFRAME	RESOURCES
Specific Objective 1: Determine whether the Project is still a National Priority following General Elections					
Obtain written confirmation on whether the Project is still a National Priority	Conduct internal meetings to determine the priority of the Project following General Elections.	EPPD	-	5 months	GORTT (Government of the Republic of Trinidad & Tobago)
Specific Objective 2: To establish a National Steering Committee for the Project.					
Establishment of a National Steering Committee	Identify the stakeholders (private and public sector including NGOs and CBOs) and contact persons for each stakeholder.	Ministry of Planning & Development (MPD)	• Environmental Management Authority (EMA) • BCRC-Caribbean	2 weeks	GORTT
	Formally contact stakeholders (via official correspondence, telephone, e-mail) to discuss the requirements of the Project.	MPD	-	1 month	GORTT
Define the Work Plan for the Committee	Identify the objectives of the Committee and form National Working Group to implement the respective modules. Establish milestones for the	MPD	• BCRC-Caribbean	1 month	GORTT, INTERNATIONAL FUNDING

OUTPUT/ACTIVITIES	TASKS	RESPONSIBLE	PARTNERS	TIMEFRAME	RESOURCES
	NWG.				
	Host informal meetings to implement the project's objectives.	MPD	• BCRC-Caribbean	8 months	GORTT
Specific Objective 3:Assess National Legislation and Propose Regulation as necessary					
Generate a Report on the review of all existing legislation, conventions and operational plans/policies with the Minamata Convention	Review and compare the existing legislation and conventions to which T&T is signatory (local and regional) to the Minamata Convention.	MPD Legal department	• EMA • BCRC-Caribbean • Min. of Energy and Energy Affairs • Min. of Health • Min. of Transport • Min. of Trade & Industry • Customs and Excise Division • Tobago House of Assembly/TEMA • Min. of National Security (ODPM, Coast Guard, Fire Services) • DNRE • SWMCOL	2 months	GORTT
Generate a Report	Review and compare the operational plans and procedures of the various governmental agencies and private sector with the Minamata Convention.	MPD	• Private Sector Organizations (AUOTT, TTMA, AMCHAM, Chamber of Commerce, TTCIC, Energy Chamber) • BCRC-Caribbean	2 months	GORTT

OUTPUT/ACTIVITIES	TASKS	RESPONSIBLE	PARTNERS	TIMEFRAME	RESOURCES
Develop a Gap Analysis of the existing regulatory framework with the Minamata Convention	Compile the information generated from the review of existing regulatory framework (above) and make recommendations.	MPD	• National Committee • BCRC-Caribbean • Ministry of Legal Affairs	2 months	GORTT
Specific Objective 4: Conduct or Update a Mercury Waste Inventory					
Develop a Mercury Waste Inventory	Review the existing Hazardous Waste Inventory and use the Mercury Toolkit to develop a Mercury Waste Inventory.	MPD	• BCRC-Caribbean • EMA • SWMCOL • Ministry of Energy & Energy Industries • NLWG	3 months	GORTT, GREEN FUND, GEF
Specific Objective 5: Determine the Organizational Structure					
Confirm the Organizational Structure	Identify the staffing demands to manage the requirements of the mercury waste storage and disposal plan.	SWMCOL	• EMA • MPD • BCRC-Caribbean	3 months	GORTT, GREEN FUND, GEF
Specific Objective 6: Identify the ESM options for Storage and Disposal					
Identify Environmentally Sound Management (ESM)	Assess the current storage and disposal options in T&T (disposal companies and technologies used to process mercury waste).	EMA	• National Committee	4 months	GORTT, GREEN FUND, GEF
	Conduct a feasibility study on the use of local options versus export; inclusive of the possibility of establishing a	MPD	• National Committee	2 months	GORTT

OUTPUT/ACTIVITIES	TASKS	RESPONSIBLE	PARTNERS	TIMEFRAME	RESOURCES
	local treatment facility to reduce the volumes for final export (will involve registration and licensing).				
Specific Objective 7: Assess costs of implementation (funding options)					
Generate a Report on the cost of Implementation	Determine the funding options for developing or improving on local options for storage and disposal versus export.	National Committee	• BCRC-Caribbean	3 months	GORTT, INTERNATIONAL: GEF, Special Fund
Specific Objective 8: Determine Schedule for Implementation **Specific Objective 9: Implementation**					
Implementation of the Action Plan	Identify the responsible persons/entities for various aspects of the Plan.	National Committee	• BCRC-Caribbean	3 months	GORTT, INTERNATIONAL
Specific Objective 10: Develop an Education & Public Awareness Campaign					
Development of an education and public awareness campaign	Use the outcomes arising out of the study to produce sector specific public awareness materials.	EMA MPD	• COPE & other NGOs • UWI & UTT • BCRC-Caribbean	3 months	GORTT
Specific Objective 11: Formulate a decision to ratify the Minamata Convention on Mercury					
Generate a country position.	Compile all relevant documents and materials arising from the study for	MPD	• BCRC-Caribbean	1 month	GORTT

OUTPUT/ACTIVITIES	TASKS	RESPONSIBLE	PARTNERS	TIMEFRAME	RESOURCES
	submission to the Minister for use in making a determination on the country's position with respect to acceding to the Minamata Convention.				