SAINT LUCIA

MINAMATA INITIAL ASSESSMENT REPORT

DEVELOPMENT OF THE MINAMATA INITIAL ASSESSMENT IN THE CARIBBEAN

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

AUGUST 2018

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

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SAINT LUCIA MINAMATA INITIAL ASSESSMENT REPORT

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Ministry of Education, Innovation, Gender Relations and Sustainable Development
Saint Lucia

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ABOUT THIS DOCUMENT

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

The project is an enabling activity for the ratification and/or implementation of the Minamata Convention on Mercury. Funding was received from the Global Environment Facility with the United Nations Environment acting as the Implementing Agency and the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean acting as the Executing Agency. Nationally, the project was executed by the Department of Sustainable Development of the Ministry of Education, Innovation, Gender Relations & Sustainable Development.

The development of the Report was guided by the Biodiversity Research Institute who was contracted as the lead technical consultancy. The report consists of an inventory of mercury releases primarily based on 2016 data. Assessments and recommendations for the effective implementation of the Minamata Convention were conducted.

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Report issuing date	August 2018

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

The report also includes an assessment of the legislative and institutional framework in relation to the implementation of the Minamata Convention on Mercury which was developed by legal consultant, Dr Winston McCalla.

Contents

List of Tables

List of Figures

List of Abbreviations

ABS	Antilock Braking Systems
AMAP	Arctic Monitoring and Assessment Programme
BAT	Best Available Techniques
BCRC-Caribbean	Basel Convention Regional Centre for Training and Technology Transfer in the Caribbean
BEP	Best Environmental Practices
BRI	Biodiversity Research Institute
CARICOM	Caribbean Community
CARPHA	Caribbean Public Health Agency
CFLs	Compact Fluorescent Lamps
CSO	Central Statistics Office
DCA	Development Control Authority
DMA	Direct Mercury Analyser
DSD	Department of Sustainable Development
EC	European Commission
EPR	Extended Producer Responsibility
EU	European Union
GEF	The Global Environment Facility
GOSL	Government of Saint Lucia
Hg	Elemental Mercury, CAS No. 7439-97-6
kg Hg/y	kilograms of mercury per year
LCD	Liquid Crystal Display
LED	Light Emitting Diodes
LFLs	Linear fluorescent lamps
LPG	Liquefied Petroleum Gas
LUCELEC	Saint Lucia Electricity Services Limited
m^3	Cubic metres
MAPs	Mercury Added Products
MIA	Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, and Trinidad and Tobago)
MSW	Municipal Solid Waste
MW	Megawatts
NEMS	National Environmental Strategy
NEP	National Environmental Policy
PPE	Personal Protective Equipment

ppm	Parts per million
PU	polyurethane
RFP	Rambally's Funeral Parlour
SEL	Specially Engineered Landfill
SIDS	Small Island Developing States
SLBS	Saint Lucia Bureau of Standards
SLSWMA	Saint Lucia Solid Waste Management Authority
t/y	Tonnes per year
THg	Total mercury
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
USEPA	United States Environmental Protection Agency
WASCO	Water and Sewerage Company of Saint Lucia
WEEE	Waste electrical and electronic equipment
WHO	World Health Organisation
ww	Wet weight
WWTP	Wastewater Treatment Plants

Foreword by Minister of Education, Innovation, Gender Relations and Sustainable Development

Mercury is a naturally occurring element in the earth's crust that presents a major public health concern as it is toxic to both humans and animals. The Minamata Convention on Mercury is a global treaty that was designed to protect human health and the environment from the adverse effects of mercury and mercury compounds. The Convention entered into force on August 16, 2017 and presently has one hundred and twenty-eight (128) signatories and ninety-six (96) ratifications.

The Global Environment Facility (GEF) has made funding available for countries that need assistance with early ratification and implementation efforts related to the Minamata Convention through enabling activities called Minamata Initial Assessments (MIAs). For this project, the United Nations Environment Programme (now United Nations Environment) acted as the Implementing Agency and the Basel Convention Regional Centre for Training and Technology Transfer in the Caribbean (BCRC-Caribbean) acted as the Executing Agency. To this end, Saint Lucia joined Jamaica, Saint Kitts and Nevis and Trinidad and Tobago in a regional project to provide adequate scientific and technical knowledge to facilitate the fulfilment of the Convention.

The MIA project aims to strengthen national decision-making towards ratification of the Convention and build national capacity for its successful implementation. As a key component of the project, Saint Lucia conducted a national mercury inventory that identified and quantified the mercury releases and emissions within the country using 2016 as the baseline. This inventory was completed using the United Nations Environment's Toolkit for Identification and Quantification of Mercury Releases - Inventory Level 2. The results of the inventory will inform the priority areas for recommended action to build national capacity for successful national implementation of the Convention's obligations.

Apart from the mercury inventory, an assessment of the policy, regulatory and institutional capacity framework was conducted for Saint Lucia. In order to successfully implement the Convention, institutional strengthening and the enactment of new legislation in accordance with components of the Convention are necessary.

Based on the results and gaps identified in the MIA project, The Ministry with responsibility for the environment will continue efforts to improve the legal framework and to strengthen institutional and administrative capacities for the sound management of chemicals and hazardous wastes. Additionally, Best Available Technology (BAT) and Best Environmental Practice (BEP) related to mercury releases will be established alongside intensive awareness raising and education activities. All of these actions will afford Saint Lucia an opportunity to accomplish the primary objective of the

Convention - protecting the environment and human health from adverse effects of mercury as well as meeting relevant Target and Goals of the 2030 Agenda for Sustainable Development.

Hon. Dr. Gale T. C. Rigobert
Minister of Education, Innovation, Gender Relations and Sustainable Development

Executive Summary

While Saint Lucia is not currently a signatory to the Minamata Convention on Mercury (as of August, 2018), meaningful steps are being taken to ratify the Convention. The Minamata Convention aims to protect human health and the environment from the anthropogenic emissions and releases of mercury and mercury compounds.

In order to assess the priorities for the ratification of the Minamata Convention's obligations, the Government of Saint Lucia participated in a project entitled, "Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, and Trinidad and Tobago)" (MIA Project). The MIA Project aims to facilitate the ratification and early implementation of the Minamata Convention on Mercury through the use of scientific and technical knowledge in participating countries. The Project outputs within each of the project countries were overseen by respective National Working Groups comprising of representatives from relevant ministries and institutional bodies.

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

The inventory primarily used 2016 data obtained through research, interviews and stakeholder questionnaires. However, for some sub-categories, data from the year 2016 was not available and so previous years or default calculations were used to develop estimates. Default calculations were based on the Toolkit assumptions and may have resulted in over- or under- estimations of the actual mercury input. Data gaps were also noted for some sub-categories where no estimations could be made

such as, the cosmetics containing mercury, mercury metal use in religious rituals and folklore medicine and; diffuse disposal under some control. The completed inventory Toolkit spreadsheet; a listing of national project stakeholders; and templates of questionnaires used for data collection, are included as Annexes to this document.

Results of the National Mercury Inventory

Based on the data available, the results of the mercury inventory conducted are illustrated in Figures 1 and 2, as well as Table 1. Total mercury releases for Saint Lucia based on the inventory data were estimated to be 75 kilograms of mercury for the year 2016.

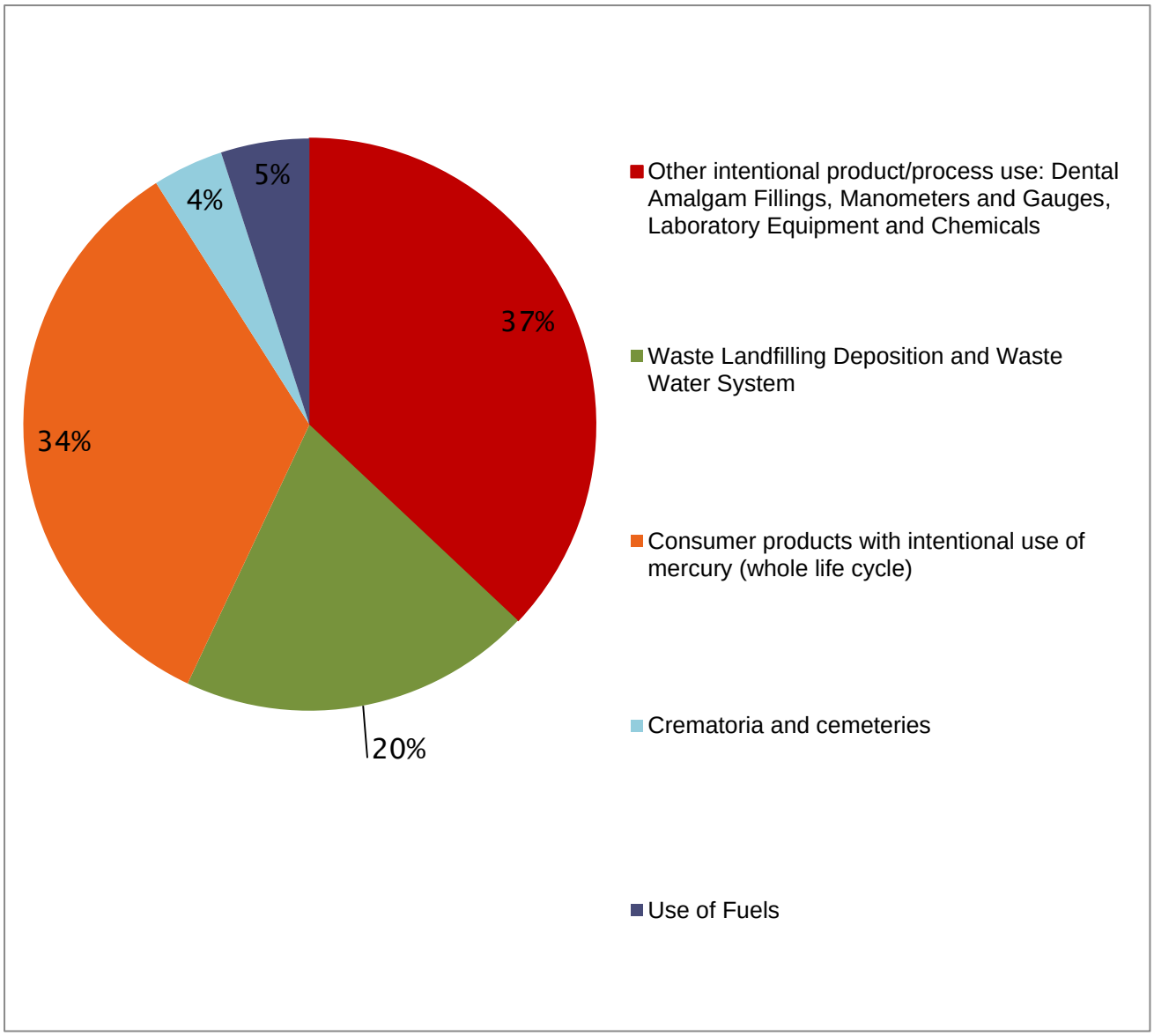

Figure 1: Estimations of total releases from the significant sources of mercury identified in the Saint Lucia mercury inventory conducted for 2016.

The most significant source of mercury releases (37%) was found to be 27.84 kilograms of mercury per year (kg Hg/y) from the sector “Other intentional product or process use” which referred to the preparation, use and disposal of dental mercury amalgam fillings; the use and disposal of manometers and gauges with mercury; and the use and disposal of laboratory chemicals with mercury. Within these sub-categories, dental amalgam fillings were found to be the most significant with releases estimated to be 24.06 kg Hg/y. It should be noted that the use of dental amalgam fillings have declined in recent years in Saint Lucia due to the growing preference for more discreetly coloured alternative fillings. However; in this inventory, estimations were made for the use and disposal of dental amalgam over the past 10- 20 years.

The use and disposal of consumer products with mercury contributed to the second highest estimated releases of mercury in Saint Lucia (25.09 kg Hg/y). The products under this category are not produced within Saint Lucia but rather imported from countries such as the United States of America and China. The use and disposal of electrical switches and relays with mercury were found to have the most significant estimated releases in this sector (20.44 kg Hg/y), followed by the use and disposal of polyurethane with mercury catalysts (4.38 kg Hg/y). Minor releases were estimated from the use and disposal of mercury-added batteries (0.10 kg Hg/y), thermometers (0.09 kg Hg/y) and light sources (0.08 kg Hg/y). The use and disposal of consumer products also contributed to the largest releases to general waste (Figure 2) with 20.3 kg Hg/y being released to this pathway.

Data obtained from the waste disposal, informal dumping of waste and waste water treatment systems in Saint Lucia accounted for 20% of mercury releases. While waste deposition in landfills contributed to an input of 359 kg of mercury estimated per year, when adjusted for double-counting from other sectors, this amounted for approximately 3 kg of mercury being released per year, mainly into the air. Up-to-date information on the informal waste dumping and wastewater treatment systems in Saint Lucia could not be obtained so data based on previously published research was used to determine average releases from these areas. Informal dumping

accounted for notable releases to land while waste water treatment contributed most significantly to mercury releases to water.

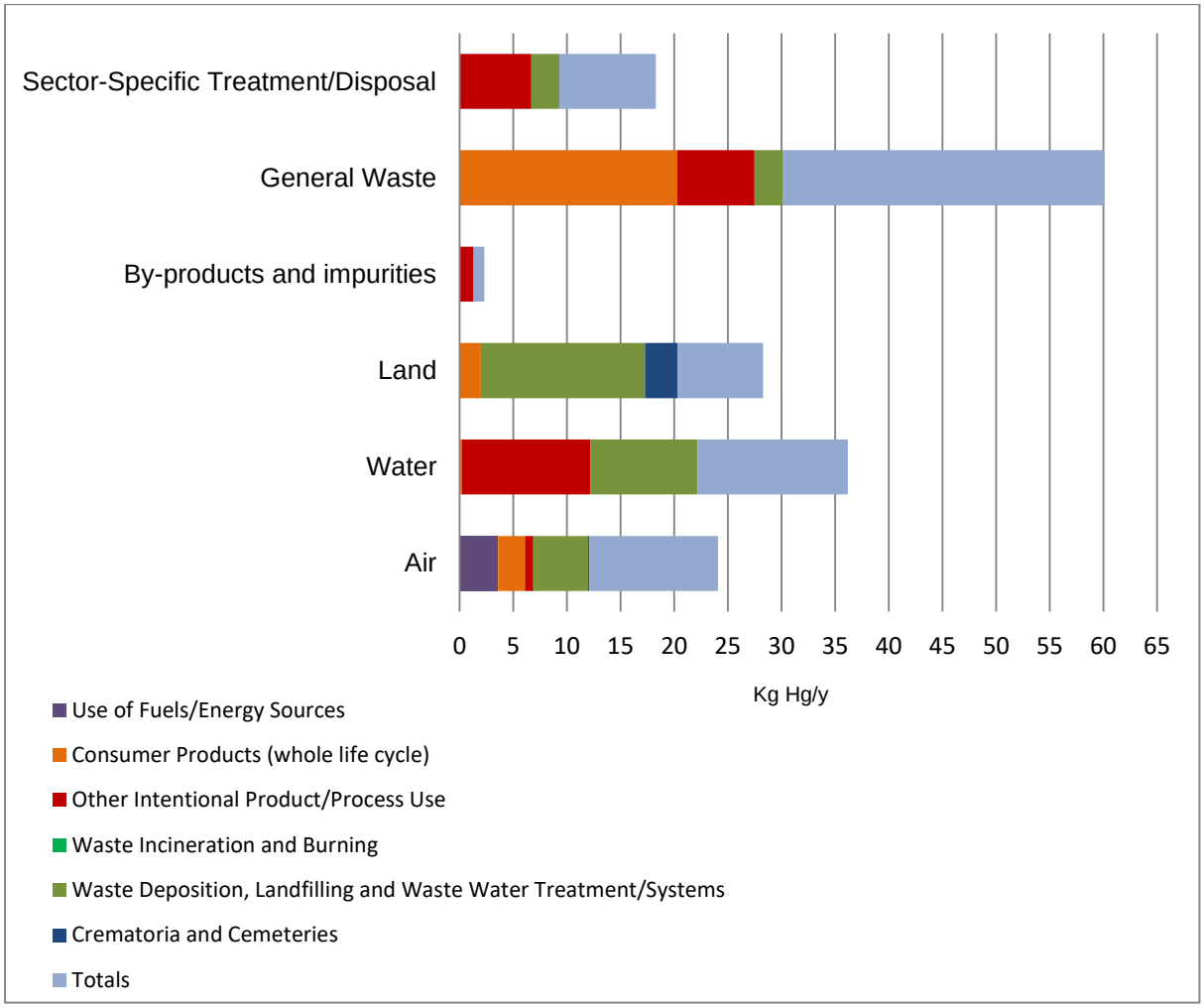

Figure 2: Estimations of releases to each output pathway from the significant sources of mercury identified in the mercury inventory conducted using 2016 data when available

A further breakdown of the results of this mercury inventory is shown in Table 1.

No mercury stockpiles over 50 metric tonnes; supply or trade generating stocks exceeding 10 metric tonnes of Hg per year; or hot spots for mercury contamination were identified in Saint Lucia. There are also no known regulated storage systems for the collection of mercury wastes generated from the disposal of mercury-added products (MAPs). As such, it was assumed that the main source of mercury contamination in the country is the disposal of mercury-added or contaminated products at landfills.

Table 1: Full Summary of mercury inventory results for Saint Lucia, 2016

Source Category	Calculated Hg Output, Kg/y							
	Air	Water	Land	By-products and impurities	General waste	Sector specific treatment /disposal	Total releases by source category	Percent of total releases [3,4]
Extraction and use of fuels/energy sources	3.6	-	-	-	-	-	4	4.8%
Primary (virgin) metal production	-	-	-	-	-	-	-	0%
Production of other minerals and materials with mercury impurities[1]	-	-	-	-	-	-	-	0%
Intentional use of mercury in industrial processes	-	-	-	-	-	-	-	0%
Consumer products with intentional use of mercury (whole life cycle)	2.5	0.2	2.0	-	20.3	-	25	33.5%
Other intentional product/process use[2]	0.7	11.6	1.8	1.3	6.5	5.9	28	37.2%
Production of recycled metals	-	-	-	-	-	-	-	0%
Waste incineration and burning	0.1	-	-	-	-	-	0	0%
Waste deposition/landfilling and waste water treatment[3,4]	5.1	10.0	15.3	-	2.6	2.6	35	20.1%
Crematoria and cemeteries	0.1	-	3.0	-	-	-	3	4.2%
SUM OF QUANTIFIED RELEASES[3,4]	12	13	10	1	29	8	75	100%

[1] Includes production of cement, pulp and paper, lime and light weight aggregates.
[2] Includes dental amalgam fillings, manometers and gauges, lab chemicals and equipment, Hg use in religious rituals and folklore medicine, and miscellaneous product uses.
[3] The estimated quantities include mercury in products which has also been accounted for under each product category. To avoid double counting, the release to land from informal dumping of general waste has been subtracted automatically in the 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, releases to water from, waste water system/treatment have been subtracted automatically in the TOTALS.

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

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

The results were presented in a map which showed that the Roame/Rugeine/Palmiste watershed on the south-east coast of Saint Lucia had moderate to high sensitivity to mercury. While the Vieux Fort Landfill is located in this area, further assessments are required to determine the extent of the relationship between the disposal site and mercury sensitivity. The identification of watersheds with higher mercury sensitivity is useful for prioritising risk reduction strategies and for directing future monitoring and mitigation efforts. The model developed can be used by the Government of Saint Lucia to further its assessments in determining mercury contaminated sites as suggested under Article 12 of the Minamata Convention.

Exposure to elemental mercury and mercury compounds can pose a higher risk to certain populations that are more sensitive to its effects or have an increased frequency of exposure. In Saint Lucia, these groups include pregnant women and women of childbearing age, foetuses, new-borns and young children, individuals with health-related preconditions, populations with a regular diet of contaminated high trophic level aquatic organisms, individuals who consistently use MAPs such as skin-lightening creams with mercury and, people living in areas that are more susceptible to environmental contamination by mercury such as locations surrounding the landfills or wastewater treatment systems. Also at risk are workers exposed to mercury on a regular basis which may include dental and medical professionals and assistants, waste handlers, environmental officers, firemen and first responders, laboratory workers and other industrial workers.

A rapid assessment of total mercury concentrations in a total of fifty-two (52) fish tissue samples from nineteen (19) different species of fish in Saint Lucia was conducted. Species with the lowest mean tissue mercury concentrations included the

Atlantic creole fish (*Paranthias furcifer*) and the Queen Conch (*Strombas gigas*). Of the 52 species sampled, eight (8) samples were found to have concentrations above the Great Lakes Commission fish consumption guidelines of 0.22 parts per million, wet weight (ppm, ww). The most elevated total mercury (THg) concentration of 0.564 ppm, ww was found in one (1) sample of Great Barracuda (*Sphyraena barracuda*). Due to the small sample size and lack of additional data, there was limited opportunity to conduct a statistical analysis on the data and to identify trends among species or potentially contaminated sites. It is recommended that additional fish sampling analysis be conducted to better inform the development of local fish advisory guidelines.

The assumption was made that mercury exposure through consumption of mercury-contaminated fish, domestic use of mercury added products, and occupational participation in the transport, storage and communication sector did not vary significantly between sexes. While information on the gender dimensions for the health and waste sectors was not available, it was estimated that due to occupations, the risk of exposure through medical-related work was greater in women and the risk from waste handling was greater in men. It was also noted that the popularity of skin-lightening creams is greater among women than men based on previous research, and the risk of using products containing mercury is therefore higher in the female population. Further studies are recommended to confirm and quantify patterns of exposure and at-risk populations, so as to inform the development of health-related policies and programmes that benefit men and women equally.

Major Findings of the Policy, Regulatory and Institutional Framework Assessment

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

The lack of appropriate legislation to effectively implement certain components of the Minamata Convention was the main barrier identified. This barrier can be overcome by the enactment of new legislation, or in appropriate cases, the promulgation of

regulations under existing legislation. Details of such recommendations are listed in Table 2. These are short to medium-term recommendations and are expected to take 6-18 months to be implemented. It should be noted that under the Minamata Convention, Article 4 is the only article relevant to Saint Lucia that has stipulated deadlines for compliance. It states that a Party must dis-allow the manufacture, import and export of certain MAPs listed in the Convention by 2020, unless the Party applies for an exemption as detailed in Article 6 upon ratification of the Convention. Therefore, should the Government of Saint Lucia decide to ratify the Minamata Convention, particular consideration should be given to the legislative amendments recommended pertaining to MAPs.

Table 2: Legislative recommendations for Saint Lucia

Legislation/Regulation	Recommendation
External Trade Act ***(6 to 12 months)***	Prohibit the further use of MAPs.
	Ban the importation of mercury and mercury products mercury using sections 3 and 4 of the External Trade Act (Chapter 13:11) and the Customs (Control and Management) Act (Chapter 15.05).
Chemical Management Policy ***(12 to 18 months)***	Develop and finalize a Chemical Management Policy to address what organization should take the lead in dealing with mercury and by extension other hazardous wastes and chemicals. Standardization can also be considered, either through use of standards for use or specification standards for chemicals or standards can also be referenced in relevant legislation.
New Legislation/Regulation ***(12-18 months)***	Enact legislation/promulgate regulations dealing with air pollution that would have provisions for the management of mercury emissions from processes such as waste incineration.
	Enact hazardous waste regulations that would address releases of mercury and mercury compounds to water and land.
	Enact legislation/promulgate regulations to implement the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
	Enact legislation/promulgate regulations to implement the Minamata Convention

Another important area of implementation identified is the need for institutional strengthening. It is recommended that the Department of Sustainable Development of the Ministry of Education, Innovation, Gender Relations and Sustainable Development take lead responsibility for the effective implementation of the Minamata Convention on Mercury. A steering committee made up of representative organisations with various roles and responsibilities for the effective implementation of the Convention should also be formed. This has been done as a National Working Group under the MIA project and can be continued post-project.

Priority Areas for Consideration in the Ratification/Implementation of the Minamata Convention

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

- Promotion of mercury-free alternative consumer products (which are already widespread on the market). Public awareness on the hazards of mercury and the benefits of using mercury-free alternatives should be enhanced to encourage a higher substitution rate. Guidance documents produced through the World Health Organization (WHO) and the Health Care Without Harm's global campaign, which aimed to shift the use of mercury-added medical devices to Hg-free alternatives by 2017 worldwide, should be utilised;

- Development of proper separation methods for the disposal of MAPs both at the household consumer level and in the landfill management procedures. The Government should ensure that the public has access to environmentally sound facilities/locations that could aid in the disposal process, as well as information and guidelines on disposing MAPs. A holistic approach for the establishment of suitable storage and disposal facilities in Saint Lucia or the wider Caribbean region to manage mercury waste as well as other hazardous wastes from all sectors would prove beneficial in the overall environmentally sound management of waste in the Caribbean.

- Management of mercury releases from processes such as waste deposition through the implementation of further best available techniques/best environmental practices (BAT/BEP) measures to ensure that maximum control and reduction of mercury emissions and releases. The efficiencies of these measures should be continuously monitored and evaluated. It is also recommended that the locations for development of future industries/processes/disposal sites should be considered with respect to environmentally sensitive areas.
- Compile a local inventory of mercury-containing cosmetics to better inform governments and the public;

Introduction

Mercury in the Environment

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

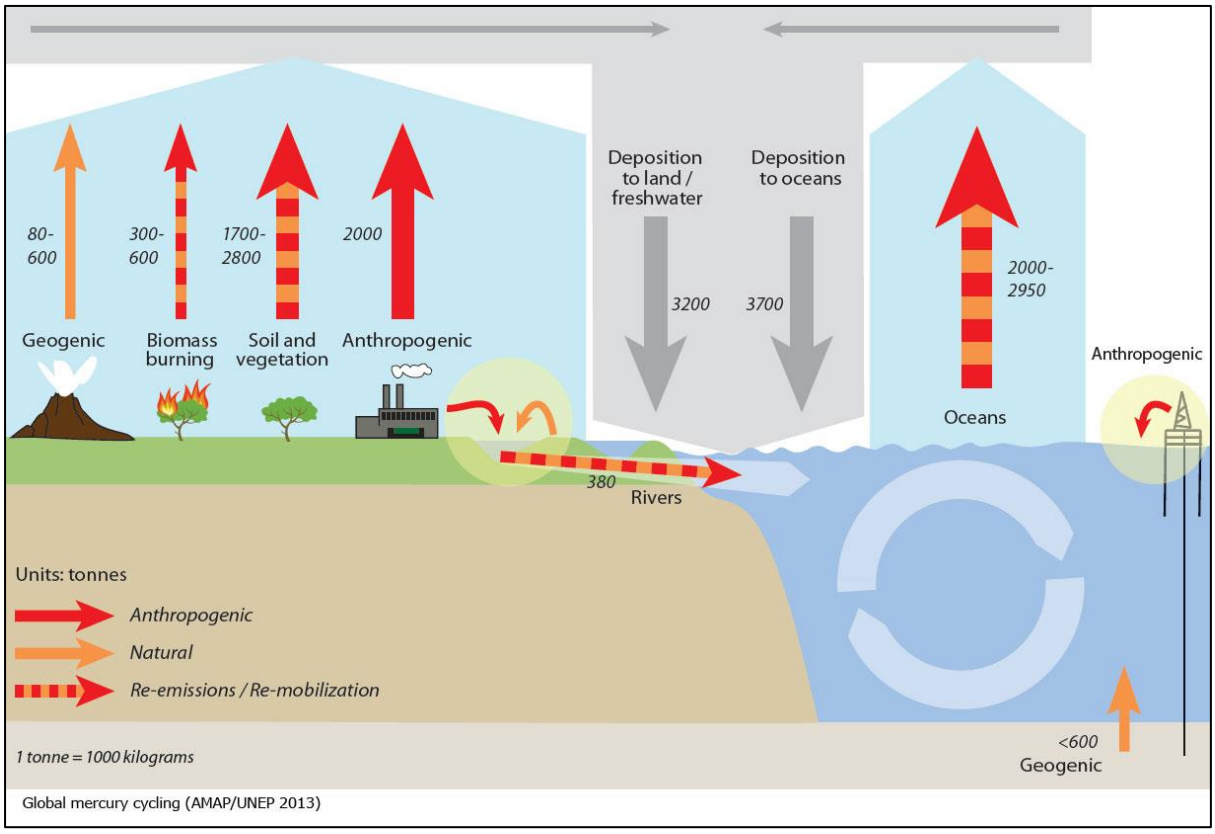

*Figure 3: The Global Mercury Cycle (UNEP 2013) [*Values in tonnes of mercury]*

As a highly toxic chemical element, mercury is considered one of the top ten (10) chemicals of major public health concern (WHO, 2017). It can damage the central nervous system and affect numerous organs, resulting in neurological and behavioral disorders. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headaches, and cognitive and motor dysfunction (UNEP,

2017a). The severe effects caused by exposure to mercury in humans are largely seen in fetuses and young children, due to their developing nervous systems.

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

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

Natural Sources

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

Anthropogenic Sources

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

In 2013, UNEP (now known as UN Environment) with the Artic Monitoring and Assessment Programme (AMAP) published the Global Mercury Assessment 2013 in which the major sources of global mercury emissions were identified and assessed. It was found that artisanal and small-scale gold mining contributed the most to mercury emissions as large amounts of elemental mercury are often used in the

process. Other key sources included coal combustion, industrial processes, and the use and disposal of MAPs, such as thermometers and compact fluorescent lightbulbs. The estimations for the top sources of mercury emissions are shown in Figure 4, with the estimated releases from Central America and the Caribbean highlighted in darker blue. From this region, the largest estimated source of mercury releases was due to artisanal and small-scale mining operations in countries, like Guyana and Suriname.

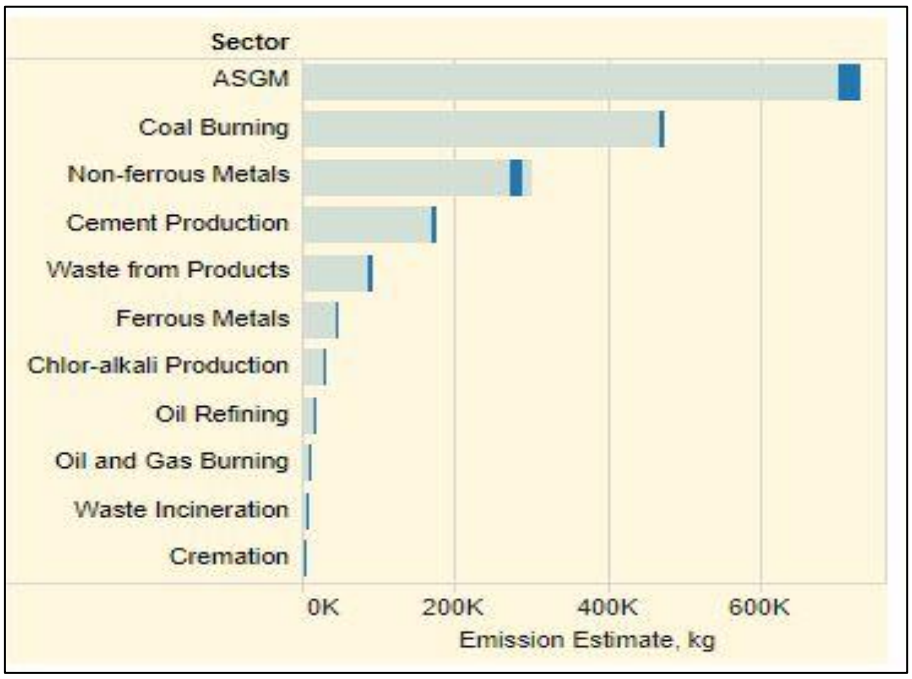

Figure 4: Estimations of global emissions of mercury based on 2010 data from various sources (metric tons). The emissions estimated from Central America and the Caribbean are highlighted in dark blue. (AMAP/UNEP, 2013)

Minamata Convention on Mercury

In order to address the negative impacts posed by the release of mercury, a global treaty called the Minamata Convention on Mercury was developed. Article 1 of the Convention states the objective which is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The text of the Minamata Convention was adopted on October 10, 2013 and the Convention entered into force on August 16, 2017. The Convention regulates, *inter alia*, mercury supply, sources and trade; mercury-added products

and processes; interim storage and disposal of mercury, its compounds and mercury waste; and the emissions and releases of mercury.

As of August, 2018, Antigua and Barbuda, Cuba, Dominican Republic, Guyana, Jamaica, Saint Kitts and Nevis and Suriname are the countries in the Caribbean region which have become Parties to the Convention.

Project Background: Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, and Trinidad and Tobago)

The project entitled, "Development of the Minamata Initial Assessment in the Caribbean (Jamaica, Saint Kitts and Nevis, Saint Lucia, and Trinidad and Tobago)", or the MIA Project, aims to facilitate the ratification and early implementation of the Minamata Convention on Mercury through the use of scientific and technical knowledge in conducting an inventory of mercury releases (and emissions)[5] in the respective countries. The MIA Project will assist the Government of Saint Lucia in the ratification of the Convention by providing a general overview of the current situation regarding mercury and its compounds in the country.

The MIA Project was funded by the Global Environment Facility (GEF), and the United Nations Environment (UN Environment; formerly the United Nations Environment Programme - UNEP) served as the implementing agency. The Basel Convention Regional Centre for Training and Technology Transfer in the Caribbean (BCRC-Caribbean) was the project executing agency with the Department of Sustainable Development (DSD) serving as the national executing agency.

The development of an inventory of mercury releases in each participating country is a key component of the project, as it will inform participating countries of their national mercury situation and subsequently assist in applying action to increase the capacity in mercury management. The sharing of experiences and lessons learned throughout the project is also expected to be an important contribution to other countries in the region. The aim of the project is to be achieved through the six components outlined in Table 3.

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

Table 3: Outline of the project components, outcomes and the expected outputs

Project Component	Project Component Outcome	Project Component Output
1. **Establishment of Coordination Mechanism and organisation of process**	Participating countries make full use of enhanced existing structures and information available dealing with mercury management to guide ratification and early implementation of the Minamata Convention	Technical support provided for the establishment of National Coordination Mechanisms and organization of process for the management of mercury
2. Assessment of the national infrastructure and capacity for the management of mercury, including national legislation	Full understanding of comprehensive information on current infrastructure and regulation for mercury management enables participating countries to develop a sound roadmap for the implementation of a national legal framework for the ratification and early implementation of the Minamata Convention	Assessment prepared of the national infrastructure and capacity for the management of mercury, including national legislation
3. Development of a mercury inventory using the UNEP mercury Toolkit and strategies to identify and assess mercury contaminated sites	Enhanced understanding on mercury sources and releases facilitated the development of national priority actions	Mercury inventory developed using the UNEP mercury tool kit and strategies to identify and assess mercury contaminated sites
4. Identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury	Improved understanding on national needs and gaps in mercury management and monitoring enables a better identification of future activities	Technical support provided for identification of challenges, needs and opportunities to implement the Minamata Convention on Mercury
5. Preparation, validation of National MIA reports and implementation of awareness raising activities and dissemination of results	Participating countries and key stakeholders make full use of the MIA and related assessments leading to the ratification and early implementation of the Minamata Convention on Mercury	Technical support provided for preparation and validation of National MIA reports and implementation of awareness raising activities and dissemination of results
6. Information exchange, capacity building and knowledge generation	Enhanced communication, support and training facilitate the development of the Minamata Initial Assessment by participating countries and build the basis for future cooperation and regional approaches for mercury management	Information exchange undertaken and capacity building and knowledge generation for mercury management provided

In order to acquire information and develop a comprehensive national mercury management strategy for the inventory of mercury releases, a stakeholder list was developed with assistance from representatives of the BCRC-Caribbean, DSD and Biodiversity Research Institute (BRI), the overall MIA Report Consultant. The stakeholders, which included professionals with experience in dealing with chemicals and environmental issues, waste disposal, industrial activities, and representatives from relevant ministries, academic institutions and non-governmental organizations, were invited to the “National Inception Workshop and Mercury Inventory Toolkit Training” held on 25th March 2017 in Saint Lucia.

Sector-specific questionnaires were presented by BRI at the inception workshop using guidelines from the United Nations Institute for Training and Research (UNITAR). These questionnaires were distributed to representatives of each sector. Face-to-face interviews were also conducted where necessary. Data collection and compilation was led by a National Project Coordinator (Inventory) hired under the Project.

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

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

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

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

This inventory was developed from February 2017 to November 2017 using data obtained primarily from the year 2016. In cases where 2016 data was unavailable, estimations were made using either data from previous years or using default calculations provided by the Toolkit. Further details are provided in the respective sections in the report. The full inventory for Saint Lucia is included as Annex 2.

Chapter 1: National Background Information

1.1 Geography and Population

Saint Lucia is a small island developing state (SIDS) found in the centre of the Windward Islands in the lower region of the Lesser Antillean Arc of the Caribbean Archipelago. The island is located at 13° 53' north latitude and 60° 58' west longitude and situated on a volcanic ridge connected to Saint Vincent and the Grenadines to the south and Martinique to the north. The island is flanked by the Caribbean Sea on the west coast and the Atlantic Ocean on the east coast.

The island covers an area of 616 square kilometres; is 42 kilometres long and 22 kilometres wide at its widest point. The coastline is approximately 158 square kilometres and the coastal shelf, which has an area of 522 kilometres, is relatively narrow and drops off sharply along the west coast. The island's terrain is considered rugged with a centralised mountain ridge. The tropical climate provides annual climatic conditions with temperatures typically ranging from 25 degrees Celsius to 30 degrees Celsius.

Saint Lucia comprises eleven (11) districts, namely: Gros Islet, Dauphin, Castries, Anse La Raye/Canaries, Soufriere, Choiseul, Laborie, Vieux Fort, Micoud, Praslin and Dennery. The population is approximately 165,595 with 77.2% under the age of 50 (Central Statistics Office, 2012). The capital city, Castries, houses approximately one-third of the population. Figure 5 shows the map of Saint Lucia.

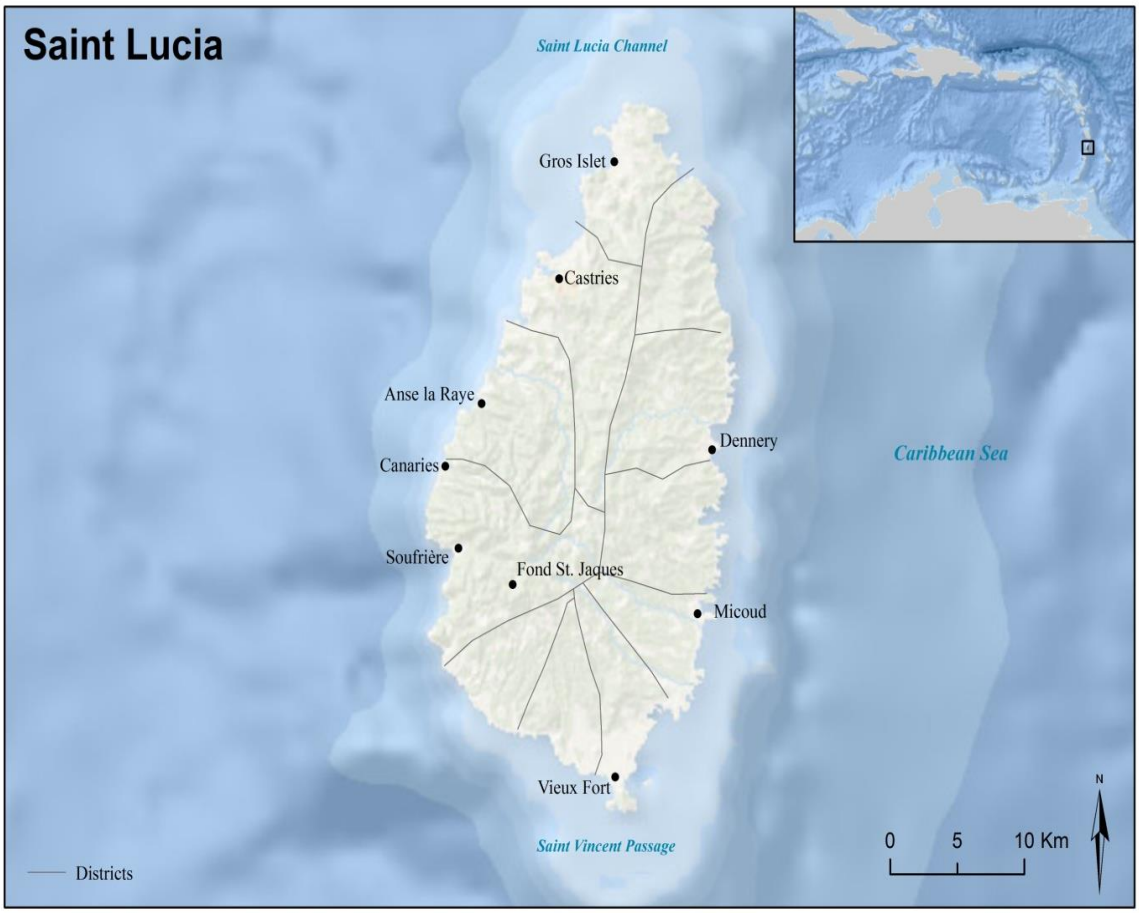

Figure 5: Map of Saint Lucia (Source: BRI, 2017)

1.2 Political, Legal and Economic Profile

Saint Lucia gained independence from the United Kingdom on February 22, 1979. It is a parliamentary democracy modelled on the Westminster System which consists of a bi-cameral parliament of seventeen (17) members of the House of Assembly and eleven (11) members of the Senate. The Governor General, who represents Her Majesty Queen Elizabeth II is the Head of State and the Prime Minister is the Head of Government.

The main source of economic revenue is tourism, which creates the largest employment sector on the island. Agriculture, including the production and exportation of bananas, mangoes and avocadoes, and the construction industry come in as the second and third largest sources of revenue respectively.

1.3 Environmental Overview

Due to its small size and location, Saint Lucia is highly vulnerable to disasters, and to the negative effects of environmental change. The Government of Saint Lucia is a Party to several multilateral environmental agreements including the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; the Stockholm Convention on Persistent Organic Pollutants and; the United Nations Framework Convention on Climate Change.

There are no published reports on the presence of mercury in Saint Lucia, however there are some potential sources of mercury release in the country. The disposal of MAPs is assumed to be one of the major sources of mercury releases, as the devices are combined with municipal waste and treated as such.

According to AMAP/UNEP (2013), waste from products and cemeteries were considered the major sources of mercury in Saint Lucia. The estimated mercury releases calculated for the major sources of mercury in Saint Lucia, can be seen in Table 4.

Table 4: Estimated mercury releases based on the Global Mercury Assessment, 2013 (AMAP/UNEP, 2013)

Sources of Mercury	Activity	Emissions Estimate, kg	Emissions Range (min-max), kg
Waste and other losses due to breakage and disposal in landfill, etc.	Waste and other losses due to breakage and disposal in landfill, etc.	3.356	0.872 - 11.074
Use in dental amalgam, emissions from human cremation	Use in dental amalgam, emissions from human cremation	0.122	0.030 - 0.409
Incineration of waste (large incinerators)	Incineration of waste (large incinerators)	0.010	0.003 - 0.034

Chapter 2: Mercury Inventory and Identification of Releases and Resources

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

2.1.1 Mercury release source types present

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

Table 5 shows the presence of the possible release sources under each category identified for Saint Lucia. The positive identifications were then further quantified using the methods highlighted in the Toolkit for Identification and Quantification of Mercury Releases Level 2 (Toolkit). The categories identified as "absent" were not discussed further in this report.

Table 5: Identification of mercury release sources in Saint Lucia; Sources present (Y), absent (N), and possible but not positively identified (?)

Source Category	Source Presence (y/n/?)
Main category - Extraction and use of fuels/energy sources	Y
Coal combustion in large power plants	N
Other coal combustion	N
Extraction, refining and use of mineral oil	Y
Extraction, refining and use of natural gas	N
Extraction and use of other fossil fuels	N
Biomass fired power and heat production	Y

Source Category	Source Presence (y/n/?)
Geothermal power production[6]	N
Main category - Primary (virgin) metal production	N
Primary extraction and processing of mercury	N
Gold and silver extraction with the mercury-amalgamation process	N
Zinc extraction and initial processing	N
Copper extraction and initial processing	N
Lead extraction and initial processing	N
Gold extraction and initial processing by other processes than mercury amalgamation	N
Alumina extraction and initial processing	N
Extraction and processing of other non-ferrous metals	N
Primary ferrous metal production	N
Main category - Production of other minerals and materials with mercury impurities	N
Cement production	N
Pulp and paper production	N
Lime production and light weight aggregate kilns	N
Others minerals and materials	N
Main category – Intentional use of mercury as an auxiliary material in industrial processes	N
Chlor-alkali production with mercury-technology	N
VCM (vinyl-chloride-monomer) production with mercury-dichloride ($HgCl_2$) as catalyst	N
Acetaldehyde production with mercury-sulphate ($HgSO_4$) as catalyst	N
Other production of chemicals and polymers with mercury compounds as catalysts	N
Main category - Consumer products with intentional use of mercury	Y
Thermometers with mercury	Y
Electrical and electronic switches, contacts and relays with mercury	Y
Light sources with mercury	Y
Batteries containing mercury	Y
Polyurethane with mercury catalysts	Y
Biocides and pesticides	N
Paints	N
Pharmaceuticals for human and veterinary uses	N

[6] As there are plans to develop geothermal power production nationally, this sector is discussed briefly in Section 2.3.3 of this report.

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

2.1.2 Summary of mercury inputs to society

Mercury inputs to society refer to the mercury amounts made available for potential releases through economic activity in the country and are identified in Table 6. This includes mercury intentionally used in products such as thermometers, blood pressure gauges, and fluorescent light bulbs.

Table 6: Summary of mercury inputs to society

Source Category	Estimated Hg Input, Kg Hg/y, by life cycle phase (as relevant)
	Use and Disposal
Main category - Extraction and use of fuels/energy sources	
Extraction, refining and use of mineral oil	0.26
Biomass fired power and heat production	3.36
Main category - Consumer products with intentional use of mercury	
Thermometers with mercury	0.09
Electrical and electronic switches, contacts and relays with mercury	20.44
Light sources with mercury	0.08
Batteries containing mercury	0.10
Polyurethane with mercury catalysts	4.38
Cosmetics and related products[1]	?
Mercury metal use in religious rituals and folklore medicine[1]	?
Main category - Other intentional products/process uses	
Dental mercury-amalgam fillings	24.06
Manometers and gauges	2.00
Laboratory chemicals and equipment	1.78
Main category – Waste incineration	
Informal waste burning- green waste and residential	0.10
Main category - Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	3.63
Diffuse deposition under some control[1]	?
Informal dumping of general waste	14.87
Waste water system/treatment	17.00
Main category - Cremation and cemeteries	
Crematoria	0.14
Cemeteries	3.03

1 Identified as possibly being present, however, not enough information to determine the quantity of mercury input to Saint Lucia.

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

- Dental mercury amalgam fillings (24.06 kg Hg/y)
- Electrical switches and relays with mercury (20.44 kg Hg/y)
- Polyurethane with mercury catalysts (4.38 kg Hg/y)

Waste and waste water produced in the country do not represent original mercury inputs to society (with the exception of imported waste) as the origin of mercury in the waste comes from the mercury in products and materials. Waste deposition to controlled landfills and waste water may represent substantial flows of mercury through society.

2.1.3 Summary of mercury releases

The key mercury releases are releases to air (the atmosphere), to water (marine and freshwater bodies, including via wastewater systems), to land, to general waste, and to sector specific waste treatment and disposal. An additional output pathway is "by-products and impurities" which designate mercury flows back into the market in by-products and products. Table 7 gives a more detailed description and definition of the output pathways.

Table 7: Description of the types of output pathways for mercury releases

Calculation Result Type	Description
Estimated Hg input, Kg Hg/y	The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury amount in the amount of coal used annually in the country for combustion in large power plants.
Air	Mercury emissions to the atmosphere from point and diffuse sources from which mercury may be spread locally or over long distances with air masses. • Point sources examples include coal fired power plants, metal smelter, and waste incinerators; • Diffuse sources examples include small scale gold mining, informally burned waste with fluorescent lamps, batteries, and thermometers.

Calculation Result Type	Description
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.) include: • Wet flue cleaning systems from coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps
Land	Mercury releases to soil, the terrestrial environment, general soil and ground water: • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction; • Uncollected waste products dumped or buried informally • Local unconfined releases from industry such as on site hazardous waste storage/burial • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer) • Application on land, seeds or seedlings of pesticides with mercury compounds
By-products and impurities	By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, include: • Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants. • Sulfuric acid produced from desulphurization of flue gas (flue gas cleaning) in non-ferrous metal plants with trace concentrations of mercury • Chlorine and Sodium Hydroxide produced with mercury-based chlor-alkali technology • Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations)
General waste	Also called municipal waste in some countries. Typical household and institution waste that undergoes a general treatment, such as incineration, landfilling or informal dumping, or burning. The mercury sources to waste are consumer products with intentional mercury content (batteries, thermometers, fluorescent tubes, etc.) as well as high volume waste like printed paper, and plastic, with trace concentrations of mercury.
Sector specific waste treatment /disposal	Waste from industry and consumers which is collected and treated in separate systems, and in some cases recycled: • Confined deposition of solid residues from flue gas cleaning on coal fired power plants on dedicated sites. • Hazardous industrial waste with high mercury content which is deposited in dedicated, safe sites • Hazardous consumer waste with mercury content, mainly separately collected and safely treated batteries, thermometers, mercury switches, lost teeth with amalgam fillings. • Confined deposition of tailings and high-volume rock/waste from extraction of non-ferrous metals The country-specific waste treatment/disposal method is described for each sub-category in the detailed report sections below.

In Table 8 below, a summary of mercury releases from all source categories present is given. The key mercury releases identified are releases to air (the atmosphere), to water (marine and freshwater bodies, including via waste water systems), to land, to general waste, and to sector specific waste. An additional output pathway is "by-products and impurities" which designates mercury flows back into the market with by-products and products.

The top three (3) mercury releases were to general waste and were estimated to be:

1. Electrical switches and relays with mercury (16.35 Kg Hg/y)
2. Dental amalgam fillings (5.00 Kg Hg/y)
3. Polyurethane with mercury catalysts (3.72 Kg Hg/y)

Table 8: Summary of mercury releases for Saint Lucia

Source Category	Calculated Hg Output, Kg/y						
	Total	**Air**	**Water**	**Land**	**By-products and impurities**	**General waste**	**Sector specific treatment/disposal**
Source category: Extraction and use of fuels/energy sources							
Mineral oils - extraction, refining and use	**0.26**	0.26	0.00	0.00	0.00	0.00	0.00
Biomass fired power and heat production	**3.36**	3.36	0.00	0.00	0.00	0.00	0.00
Source category: Consumer products with intentional use of mercury							
Thermometers with mercury	**0.09**	0.01	0.03	0.00	-	0.05	0.00
Electrical switches and relays with mercury	**20.44**	2.04	0.00	2.04	-	16.35	0.00
Light sources with mercury	**0.08**	0.00	0.00	0.00	-	0.08	0.00
Batteries with mercury	**0.10**	0.00	0.00	0.00	-	0.10	0.00
Polyurethane with mercury catalysts	**4.38**	0.44	0.22	0.00	-	3.72	0.00
Source category: Other intentional product/process use							
Dental mercury-amalgam fillings (b	**24.06**	0.54	10.44	1.76	1.32	5.00	5.00
Manometers and gauges with mercury	**2.00**	0.20	0.60	0.00	0.00	0.90	0.30
Laboratory chemicals and equipment with mercury	**1.78**	0.00	0.59	0.00	0.00	0.59	0.61
Mercury metal use in religious rituals and folklore medicine	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00
Source category: Waste incineration[7]							
Informal waste burning	**0.10**	0.10	0.00	0.00	0.00	0.00	0.00
Source category: Waste deposition/landfilling and waste water treatment							

[7] : 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.

Controlled landfills/deposits[7]	**3.63**	3.59	0.04	0.00	0.00	0.00	0.00
Informal dumping of general waste[7,8]	**14.87**	1.49	1.49	11.90	-	-	-
Waste water system/treatment[9]	**17.00**	0.00	8.50	3.40	0.00	2.55	2.55
Source category: Crematoria and cemeteries							
Crematoria/cremation	**0.14**	0.14	0.00	0.00	-	0.00	0.00
Cemeteries	**3.03**	0.00	0.00	3.03	-	0.00	0.00
SUM OF QUANTIFIED INPUTS AND RELEASES[7,8,9,10]	**75.58**	12.17	13.40	10.24	1.32	29.34	8.46

[8] 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.
[9] The estimated release to water include mercury amounts which have also been accounted for under each source category. To avoid double counting release to water from waste water system/treatment have been subtracted automatically in the TOTALS.
[10] To avoid double counting of mercury in products produced domestically and sold on the domestic market (including oil and gas), only the part of mercury inputs released from production are included in the input TOTAL.

2.1.4 Summary of mercury stockpiles, supply and trade

The Minamata Convention on Mercury outlines the obligations of Parties in terms of managing mercury supply sources and trade in Article 3. The provisions of the article refer to restrictions for the Party's territory regarding:

- primary mercury mining;
- individual stocks of mercury or mercury compounds exceeding 50 metric tons;
- sources of mercury supply generating stocks exceeding 10 metric tons per year; and
- the import and export of mercury under circumstances described within the article.

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

In Saint Lucia, no such mercury stockpiles, supply or trade exist.

2.2 Identified Hot-Spots of Mercury Contamination (contaminated sites)

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

Hot-spots of mercury contamination exist as the direct result of the use and release of mercury in processes, as well as the inadequate disposal of mercury-contaminated materials in landfills. The potential presence of such hot spots in Saint Lucia was indicated by stakeholders at the National Inception Workshop held in March, 2017 and is shown in Table 9.

Table 9: Identification of potential hot spots of mercury in Saint Lucia; Sources present (Y), absent (N), and possible but not positively identified (?)

Potential Hot Spots	Source Presence (y/n/?)
Closed/abandoned chlor-alkali production sites	N
Other sites of former chemical production where mercury compounds are/were produced (pesticides, biocides, pigments etc.), or mercury or compounds were used as catalysts (VCM/PVC etc.)	N
Closed production sites for manufacturing of thermometers, switches, batteries and other products	N
Closed pulp and paper manufacturing sites (with internal chlor-alkali production or former use of mercury-based slimicides)	N
Tailings/residue deposits from mercury mining	N
Tailings/residue deposits from artisanal and large-scale gold mining	N
Tailings/residue deposits from other non-ferrous metal extraction	N
Sites of relevant accidents	N
Dredging of sediments	N
Sites of discarded district heating controls (and other fluid controls) using mercury pressure valves	N
Sites of previous recycling of mercury ("secondary" mercury production)	N

As none of the major potential hot spots for mercury contamination are present in the country, it is assumed that the main source of mercury contamination is due to the disposal of mercury containing or contaminated products at landfill/disposal sites.

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

The predictor variables accepted for use in Saint Lucia are shown in Table 10. The percent coverage of rice, waterbodies, ponds and lakes were not relevant, and wastewater treatment plant and bauxite plant occurrence data were not needed for the mercury sensitivity by watershed analysis in Saint Lucia.

Table 10: The predictor variables for Saint Lucia (X=present)

	Predictor Variable	Saint Lucia
Percent Coverage	Mangrove	X
	Forest Cover	X
	Agriculture	X
	Rice	
	Wetlands	X
	Waterbodies	
	Ponds, Lakes, Swamps	
	Ponds, Lakes	
Occurrence Data	Wetlands	X
	Landfills and Disposal Sites	X

	Predictor Variable	Saint Lucia
	Wastewater Treatment Plants	
	Bauxite Plants	

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

The results were presented in a map (Figure 6) which showed that the Roame/Rugeine/Palmiste watershed on the south-east coast of Saint Lucia had moderate to high sensitivity to mercury. While the Vieux Fort Landfill is located in this area, further assessments are required to determine the extent of the relationship between the disposal site and mercury sensitivity. The identification of watersheds with higher mercury sensitivity is useful for prioritising risk reduction strategies and for directing future monitoring and mitigation efforts.

To further optimize the analysis, the presence and location of additional potential sources of mercury should be verified. To do this, relevant authorities in Saint Lucia should document the location of informal dumping sites. Other potential point sources of mercury inputs to society should also be identified.

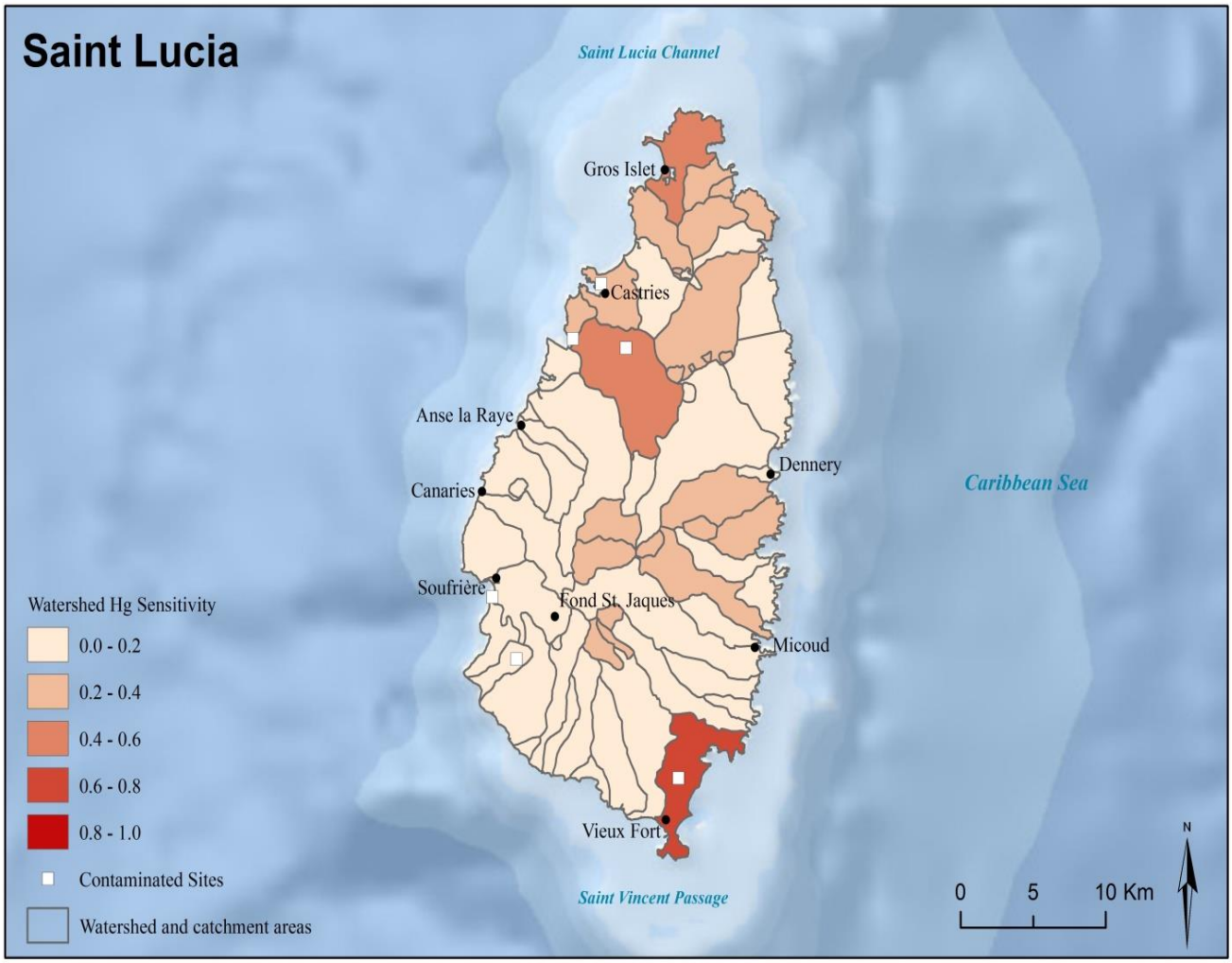

Figure 6: Saint Lucia watershed mercury sensitivity analysis results (SOURCE: BRI, 2017)

2.3 Data and Inventory on Energy Consumption and Fuel Production

Saint Lucia does not extract, refine or process any fuel sources listed under this inventory. Prior to the 1930's, coal was the main energy source used for transportation and power generation in Saint Lucia. After the 1930's, oil replaced coal as the energy source for the country (Cameron 2013). Coal is not imported or combusted and there is currently no known use of natural gas, oil shale or peat in Saint Lucia.

2.3.1 Use of mineral oil

Mineral oil, also known as petroleum oil or simply 'oil', is combusted to provide power, heat, transportation (gas & diesel engines) and other uses such as road asphalt, synthesis of chemicals, polymer production, lubricants and carbon black production (black pigments). Similar to coal as a natural raw material, mineral oil contains small amounts of natural mercury impurities which are released into the biosphere via extraction and use (UNEP, 2017a).

Saint Lucia is almost completely dependent on the importation of fossil fuels for power generation and transportation. As a result, the country's economic sectors are affected when oil prices fluctuate. Due to these uncertainties and its large technical potential in renewable energy, Saint Lucia seeks to generate 35% of its energy from renewable sources, such as solar, by 2020 (GOSL, 2010).

Petroleum products are imported from Trinidad and Tobago, Latin America and the United States of America. Saint Lucia imports crude oil; however, it is not used in Saint Lucia but stored by the sole petroleum holding company, Buckeye St. Lucia Terminal Partners Ltd, to be exported to other markets (Buckeye Terminals, 2017).

The main petroleum products imported into Saint Lucia are diesel, gasoline, liquefied petroleum gas (LPG), kerosene, jet fuel and lubricating oils. The majority of all petroleum products are purchased from Buckeye St. Lucia Terminal Partners Ltd by wholesale and retail stores in Saint Lucia (Buckeye Terminals, 2017).

Power Plants

Saint Lucia Electricity Services Limited (LUCELEC) is the sole power generation company on the island. Prior to 1990, there were two generating stations supplying the north and south of the island but, both plants were shut down due to inefficiency (LUCELEC, 2016). Currently, there is one power plant, the Cul De Sac Power Plant, of maximum capacity 60.3 megawatts (MW) (Table 11), which feeds seven substations throughout the island. The power plant is powered by ten (10) diesel engines (three 6 MW, four 9.3 MW and three 10.2 MW engines) with four 1.1 MW backup diesel engine power generators. The diesel oil is purchased from Buckeye St. Lucia Terminal Partners Limited.

Table 11: Summary of power plant operations in Saint Lucia in 2016

Power Plant	Plant Capacity Installed (MW)	Plant Capacity Effective (MW)	Type of Fuel Used
Cul De Sac	85.8	60.3	Number 2 Light Distillate, Ultra-Low Sulphur Diesel

Transportation and other uses

Rubis West Indies Limited and Sol EC (Saint Lucia) Limited are the two main suppliers of gasoline, LPG, kerosene, diesel and lubricating oils on island (Table 12). Gas stations and retailers purchase products from these main suppliers to sell to consumers (Petroleum Dealers Association, 2017).

Table 12: Summary of suppliers of mineral oils in Saint Lucia

Suppliers	Kerosene (t/yr.)	Diesel (t/yr.)	Gasoline (t/yr.)	Lubricating Oil (t/yr.)
Rubis West Indies	1,325	11,323	29,780	Not recorded
Sol EC	Not received	Not received	Not received	Not received
Total	1, 325	11,323	29,780	Not available

Data collection and assessment

Questionnaires about fuel use were delivered to LUCELEC, Buckeye St. Lucia Terminal Partners Ltd, Rubis West Indies and SOL EC (Saint Lucia) Ltd and follow-ups were conducted through interviews with company representatives to gather data. At the time of the inventory, data was not received from SOL EC (Saint Lucia) Ltd.

Mercury concentration in fuel is dependent on the local geology from which it was extracted (UNEP, 2017a). Based upon information received from the power generation company, the petroleum holding company and other retailers of petroleum products, gasoline, kerosene and diesel have been imported from Trinidad and Tobago and most recently, the United States of America. For other petroleum products such as lubricating oils, imports were received from Latin America and the United States of America. It is difficult to estimate the mercury concentrations for mineral oils imported as the exact country or area that the crude oil was extracted from is not known. There is no local data on the mercury content of fuel imported into Saint Lucia and so the Toolkit's default input factor of 2 mg mercury per metric ton of oil was used.

There are no conventional flue-gas control measures for the combustion stacks at the Cul De Sac power plant however; there are oil traps that prevent the less dense oil from entering the waterways. This oil is then collected into a tank and recycled by third party companies for fuelling their boilers. Used oil and dirty fuel are also collected and combusted in engines as necessary.

An assessment of the estimates (activity, input and output data) made for this category is shown in Table 13. Information from other oil distribution companies was unavailable at the time of the inventory and should be obtained in further assessments in order to make better estimates of annual mercury input and output.

Table 13: Certainty assessment of the data estimates used for the use of mineral oil.

Data Type	Assessment	Reason/Comment
Activity Data	Medium	2016 information received from Companies, however still missing vital information from one oil distribution company.
Input Data	Low	There was no local data on mercury content for imported fuel and the default input data from UNEP Toolkit 2017 was used.
Output Data	Low	It is based on Toolkit's default output distribution factors that assumed that all mercury releases were atmospheric. Missing information also reduces range of output data.

Table 14 provides a summary of the inputs and releases for the use of mineral oils (gasoline, diesel, light fuel oil, kerosene, LPG and other light distillates) determined by the 2016 data used for this inventory.

Table 14: Summary of mercury releases from the use of mineral oils in 2016

Use of Mineral Oils	Unit	Use	
		Other Oil Products (Transportation and other uses other than combustion)	Other Oil Products (Other Oil Combustion Facilities)
Activity rate	t oil/y	42,428	87,777
Input factor for phase	mg Hg/t oil	2	2
Calculated input to phase	kg Hg/y	0.085	0.176
Output distribution factors for phase:			
- Air	N/A	1.00	1.00
- Water	-	-	-
- Land	-	-	-
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-
Calculated outputs/releases to:			
- Air	kg Hg/y	0.09	0.18
- Water	-	-	-
- Land	-	-	-
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-

2.3.2 Biomass fired power and heat production

Biomass refers to the combustion of wood including barks, twigs, sawdust and wood shavings and/or the combustion of agricultural residues including straws, citrus pellets, coconut shells and poultry litter. Biomass is combusted using wood-fired boilers, wood stoves, other types of biomass fired boilers and biomass burning. Mercury that is naturally present in the biomass, is mainly released to the atmosphere.

Biomass is not used on a large scale to provide fuel for industrial heating or cooking in Saint Lucia. Residents frequently engage in the practice of charcoal and fuelwood combustion for residential cooking (Table 15). The data collected for this sub-category is based on the year 2010. It should be noted that since that time, the use of biomass may have reduced.

Table 15: Summary of biomass used in Saint Lucia

Type of Biomass	Amount Removed t/yr.
Charcoal Production	27, 302
Fuelwood	2,681

Data collection and assessment

There are no 2016 measurements of charcoal use in Saint Lucia, but the amount of charcoal used/combusted can be estimated from the average usage for the years 2000-2009. This information was based on Saint Lucia's Greenhouse Gas Inventory 2010, produced in 2015.

There is no local data on mercury content for biomass in Saint Lucia. The Toolkit has separated biomass into two categories based on mercury concentration:

1. Biomass fired power and heat production; and
2. Charcoal combustion.

The default input factors used for biomass fired power and heat production was 0.03 g Hg per metric tonne of biomass and charcoal combustion was 0.12 g Hg per metric tonne of charcoal (four times the concentration of mercury in biomass fired power).

There are no emission controls for charcoal combustion. An assessment of estimates made for combustion of biomass is shown in Table 16.

Table 16: Certainty assessment of the data estimates used for biomass fired power and heat production

Data Type	Assessment	Reason/Comment
Activity Data	Low	Estimates were made from extrapolated data for 2010. The activities of this category may have since declined.
Input Data	Low	There was no local data on mercury content for biomass, and so the default input data from the Toolkit was used.
Output Data	Low	It was assumed that all mercury releases are atmospheric. However, some mercury may be released into the ashes or residue of the burnt biomass.

More recent information on the use of charcoal in Saint Lucia will be required to provide better estimates of annual mercury releases. The calculated mercury outputs are shown in Table 17.

Table 17: Summary of mercury releases for biomass fired power and heat production in 2010

Biomass Fired Power and Heat Production	Unit	Use	
		Biomass (fuelwood)	Charcoal
Activity rate	t/y	2,681	27,302
Input factor for phase	g Hg/t (dry weight)	0.03	0.12
Calculated input to phase	kg Hg/y	0.08	3.28
Output distribution factors for phase:			
- Air	N/A	1.00	1.00
- Water	-	-	-
- Land	-	-	-
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-
Calculated outputs/releases to:			
- Air	kg Hg/y	0.08	3.28
- Water	-	-	-
- Land	-	-	-
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-

2.3.3 Geothermal power production[11]

The Sulphur Springs in Saint Lucia is considered the hottest and most active geothermal site in the Lesser Antilles. This makes Saint Lucia a prime and highly potential site for geothermal production. Numerous studies have been carried out over the past 50 years to investigate the geothermal energy potential of the Sulphur Springs, but to date, no attempt at exploitation has been made (The UWI Seismic Research Centre, 2011). If exploration into production from this resource is explored in the future, measures should be put in place to ensure that releases of naturally present mercury are managed in an environmentally sound manner.

[11] Determined to not be present at the time of the inventory, but included briefly as it may be relevant in Saint Lucia in the near future.

2.4 Data and Inventory on Consumer Products with the Intentional Use of Mercury

Consumer products with the intentional use of mercury throughout their life cycle would be a priority area for action for Saint Lucia in terms of implementing the Minamata Convention on Mercury. Under the Convention, Parties must phase out the manufacture, import and export of certain MAPs listed under Annex A by the year 2020.

It was determined that the following sources were not present in Saint Lucia:

- Biocides and pesticides with mercury
- Paints with mercury
- Pharmaceuticals for human and veterinary uses

Currently, the main areas of concern in the life cycle of mercury products for Saint Lucia are their import, use and disposal. Data used in this section was obtained mainly from Customs data sheets and by using default calculations in the Toolkit spreadsheet.

2.4.1 Thermometers containing mercury

Historically, mercury has been used in thermometers because of its low vapour pressure which makes it ideal for detecting small changes in temperature and facilitates measurements within a large range of temperatures (EPA, 2016). Different types of mercury thermometers have been used for medical applications, ambient air temperature monitoring, laboratory or educational purposes, or industrial uses and special applications, such as for the control of large diesel engines in ships.

The Department of Health and Wellness regulates all medical devices imported and exported from the country. According to the Department, there are approximately three (3) main wholesale distributors of medical instruments in the country.

Based on interviews with various medical personnel, there has been a large reduction in the number of medical mercury thermometers in the last five (5) years. Interviews with medical officials have concluded that the use of digital and other alternative thermometers is increasing in the healthcare sector.

Mercury thermometers are also used in the meteorological industry and factories but in limited amounts. These thermometers are infrequently imported into the country and thus have not been included in this inventory.

According to health officials interviewed, the average life span of a mercury clinical thermometer can range from a few months to a couple of years. Approximately 90% of all mercury thermometers are broken within one to two months of usage. Once a thermometer is broken, the priority of the medical personnel is to clean up the debris and glass to prevent contamination or injury to others. Therefore, broken thermometers are often disposed of as general waste rather than hazardous waste. Mercury thermometers from residences will normally be included in general waste.

Data collection and assessment

Questionnaires regarding the use and number of mercury-containing medical equipment were sent to laboratories, the Customs and Excise Department, medical practitioner offices, medical institutions, and the Department of Health and Wellness. Interviews were also held with various personnel from the Department of Health and Wellness, the Saint Lucia Meteorological Office and the Saint Lucia Manufacturer's Association.

Mercury thermometers may contain 0.6 to several 100 grams of mercury per unit; the exact content depends on the use of the thermometers and the manufacturing standards. Local data on the mercury content in medical or other types of thermometers were unavailable, so the Toolkit's default input factor of 1 g Hg per unit was used. Data received from 2012-2016 indicated that medical thermometers are typically imported in Saint Lucia every other year. In 2013, 360 medical thermometers were imported, all assuming to contain mercury. In 2015, the number imported reduced to 96.

There is no separate collection or disposal method for mercury thermometers. Should thermometers be disposed of as hazardous waste, they will be treated as such at the sanitary landfill. Mercury is normally sealed in a thermometer, but can be released once the thermometer breaks. Based on the assumption that 90% of thermometers break

before the end of their life span, it is estimated that a total of 86 thermometers were disposed of during 2016[12].

The default output distribution factors in the Toolkit assume that when the thermometers are disposed of, mercury is released in the following proportions: 10% to air, 30% to water and 60% to general waste. These factors are based on the assumption that there is no or very limited separate collection of thermometers after use and that all or most of the general waste is transferred to a landfill. Based on the low number of thermometers imported into Saint Lucia, the outputs of mercury from this sector are low at approximately 0.09 kg being released to the environment, according to the Toolkit**.**

Customs and Excise Department's data covers all thermometers that are imported into the country including alternatives like digital and liquid-in-glass thermometers. There is the possibility of other thermometers entering the country that are not recorded. An assessment of mercury release estimates made for mercury thermometers is shown in Table 18.

Table 18: Certainty assessment of the data estimates used for thermometers with mercury

Data Type	Assessment	Reason/Comment
Activity Data	High	This is based on information from the Department of Health and Wellness.
Input Data	Low	No local data on mercury content in thermometers and so the default input data from the Toolkit was used.
Output Data	Medium	Based on default output distribution factors from the Toolkit.

Table 19 provides a summary of the analysis conducted under this inventory to assess mercury inputs and releases from medical thermometers.

[12] Number imported for 2015 x 0.9 = 85.4 (rounded off to 86).

Table 19: Summary of mercury releases from the use and disposal of mercury thermometers imported in 2015

Use and Disposal of Thermometers with Mercury	Unit	Use and Disposal
Activity rate	items/y	86
Input factor for phase	g Hg/item	1
Calculated input to phase	kg Hg/y	0.09
Output distribution factors for phase:		
- Air	N/A	0.1
- Water	N/A	0.3
- Land	-	-
- Products	-	-
- General waste treatment	N/A	0.6
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	kg Hg/y	0.01
- Water	kg Hg/y	0.03
- Land	-	-
- Products	-	-
- General waste treatment	kg Hg/y	0.05
- Sector specific waste treatment	-	-

2.4.2 Electrical switches and relays containing mercury

Electrical switches and relays can be found in numerous electrical apparatus and elemental mercury has been a commonly used component in these devices. Globally, mercury-free switches and relays have become more popular in the last two (2) decades, but due to the long service life of most switches and relays, mercury-containing components are expected to be present in disposed wastes for many years (UNEP, 2017a).

The most common use of elemental mercury in the manufacture of electrical equipment is in tilt switches or “silent” switches which are used for silent electric wall switches, convenience lights (such as those used in car trunks when opened), Antilock Braking

Systems (ABS) and active ride-control systems in vehicles; as well as thermostats for air conditioning and ventilation units.

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

Many of the electrical products used in Saint Lucia are obtained from developed countries. There is also an environmental levy on all used cars, which dissuades persons from obtaining cars older than two (2) years and persons can be fined in addition to the cost and duties associated with importing the vehicle.

ABS systems and convenience switches containing mercury have been banned from the European Union (EU) (1996) and the United States of America (2001) (UNEP, 2017a). Older derelict vehicles containing contacts and relays which may use mercury are normally transported to the Sanitary Landfill or left by the residence until it is towed away to the landfill.

Data collection and assessment

Due to switches and relays being components of larger products that are imported into the country, the number used and whether mercury was a component could not be specifically determined. Therefore, the estimation for mercury releases from electrical switches and relays in the Toolkit was determined by using the default calculations provided that was based on electrification rate, population data and a default mercury input concentration. Population data from 1996 was used to give a more accurate estimation of the historical consumption data. While switches and relays are not collected separately, there is some degree of control in their disposal, as electrical waste and discarded vehicles are stored separately from general waste at the landfill sites. The certainty of the data was assessed and shown in Table 20.

Table 20: Certainty assessment of the data estimates used for electrical switches and relays containing mercury

Data Type	Assessment	Reason/Comment
Activity Data	Low	Based on the default factors for population data and electrification rate used in the Toolkit spreadsheet.
Input Data	Low	Based on the default factor used in the Toolkit spreadsheet.
Output Data	Low	Based on Toolkit's default output distribution factors.

Table 21 summarises the mercury input factors and releases via relevant pathways for electrical switches and relays determined.

Table 21: Summary of mercury releases from the use and disposal of electrical switches and relays based on 1996 population data

Use and Disposal of Electrical Switches and Relays with Mercury	Unit	Use and Disposal
Activity rate	inhabitants	149,004
Input factor for phase	g Hg/(y*inhabitant)	0.14
Calculated input to phase	kg Hg/y	20.44
Output distribution factors for phase:		
- Air	N/A	0.1
- Water	-	-
- Land	N/A	0.1
- Products	-	-
- General waste treatment	N/A	0.8
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	kg Hg/y	2.04
- Water	-	-
- Land	kg Hg/y	2.04
- Products	-	-
- General waste treatment	kg Hg/y	16.35
- Sector specific waste treatment	-	-

2.4.3 Light sources with mercury

Mercury is used in small amounts in different types of discharge lamps, linear fluorescent light tubes, compact fluorescents and specialty lamps (such as metal halide, mercury vapour, high pressure sodium, and neon lamps). They are used for both commercial and municipal use. Other light sources that may contain mercury include special lamps for photographic purposes, atomic absorption spectrometry lamps, ultraviolet sterilisation, and back lights of flat-screens for computers (UNEP, 2017a).

Mercury is used as a multiphoton source as it produces ultra-violet light when an electric current is passed through the tube. Eventually the light loses its efficiency as mercury in the tube reacts with the phosphorus powder which coats the inside surface of the tube. The lifespan of these lighting devices varies between five (5) to ten (10) years and while they are in use, there is no risk of mercury exposure. However; if broken and when disposed of, mercury vapour may be released to the atmosphere.

Municipal and commercial light sources

Compact fluorescent lamps (CFLs) and linear fluorescent lamps (LFLs) are commonly used for lighting commercial and municipal buildings in Saint Lucia. CFLs consume less energy than a conventional incandescent light bulb. As Saint Lucia is a net importer of fossil–based energy, a project was undertaken in 2007 to encourage and promote the use of CFL bulbs within businesses and homes to help reduce electricity consumption (DeMos et al, 2007). In 2015, another project was implemented that encouraged the use of CFLs as well as LEDs. The Caribbean Energy Efficient Lighting Project was implemented mainly due to the energy efficiency and cost savings of CFLs and LEDs (CARICOM, 2015). During the past few years, LEDs have become increasingly popular, and can be seen in the product availability by many large wholesalers on island.

Street lighting

Mercury vapour lamps were used for street lighting in Saint Lucia, until replaced by high pressure sodium lamps approximately 10-15 years ago. The Government of Saint Lucia is intending to replace its entire network of 21,500 high pressure sodium lamps with LED lamps by the end of 2018 (CDB, 2016).

Disposal of light sources

A light bulb is intended to last 5-10 years with continuous use with approximately 5% of all fluorescent light sources being broken before the end of their life span. In Saint Lucia, light bulbs are collected with municipal solid waste. Based on estimates by solid waste experts consulted during the inventory development, almost 20% of all light bulbs are broken prior to reaching the landfill and the remaining 80% are received intact (SLSWMA, 2017).

Figure 7: Bulb crusher present at Deglos Sanitary Landfill (photo provided by NPC, Beana Joseph, 2017)

The Deglos Sanitary Landfill commissioned a fluorescent bulb crusher (Figure 7) in 2015 to alleviate the concerns of mercury concentrations in waste. According to the Saint Lucia Solid Waste Management Authority (SLSWMA), the bulb crusher is capable of crushing only one LFL at a time and uses a charcoal filter to remove the mercury vapour from the bulb. The charcoal filter and other waste are exported to the company responsible for recycling or disposal. Presently, the bulb crusher is not in use as there are no special waste collections for LFLs. Therefore, most of the lamps are mixed with the general waste and cannot be recovered.

Data collection and assessment

Questionnaires were distributed to the Customs and Excise Department and various wholesalers of lights. Interviews were held with LUCELEC street lighting personnel and other retailers. Data for 2016 was obtained.

The mercury content for light sources in Saint Lucia is not known and therefore the default input factors for mercury content from the Toolkit were used.

A light source may last as long as 5 years, therefore the ideal year to receive information for use/disposal should be 1996-2011. However; quantity information for 2011 was not available. It is assumed that the numbers imported in 2016, were similar to the numbers imported in 2011. This may be an under-estimation considering LEDs were introduced to Saint Lucia in large quantities in 2015, which may have caused few CFLs to be imported in 2016.

The default output distribution factors for the release of mercury in light sources was 0.05 to air and 0.95 to general waste, based on the fact that there is no to very limited separate lamp collection and that the majority of these light sources are sent to a landfill.

An assessment of estimates for light sources is shown in Table 22.

Table 22: Certainty assessment of data estimates used for light sources with mercury

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Information received from Customs however; it was assumed that the specific products contained mercury.
Input Data	Medium	As there is no local data on mercury content for light sources imported, the default input data from the Toolkit was used.
Output Data	Medium	Based on the assumption that all light sources mentioned contain mercury.

It may be useful to distinguish the quantities of metal halide lamps, mercury vapour lamps and high pressure sodium lamps for future assessment. Averages of mercury content for these light sources were used and may have affected the mercury output calculation. If quantities are separated, each light source will have a more accurate calculated output based on its specific mercury content.

The mercury content data for each light source based on its country of origin will be required to calculate accurate mercury outputs to the environment. It may be useful to measure mercury content of various light sources to develop a more accurate assessment of the mercury input/output per light source.

Table 23 indicates the mercury inputs and releases from light sources imported in 2016 in Saint Lucia. The releases were estimated to be very low at 0.08 kg Hg/y.

Table 23: Summary of mercury releases from the use and disposal of light sources containing mercury imported in 2016

Use and Disposal of Light Sources with Mercury	Unit	Use and Disposal	
		UV Lights for Tanning	Metal Halide Lamps[13]
Activity rate	items/y	375	2907
Input factor for phase	mg Hg/item	15	25
Calculated input to phase	kg Hg/y	0.01	0.07
Output distribution factors for phase:			
- Air	N/A	0.05	
- Water	-	-	
- Land	-	-	
- Products	-	-	
- General waste treatment	N/A	0.95	
- Sector specific waste treatment	-	-	
Calculated outputs/releases to:			
- Air	kg Hg/y	0.0	
- Water	-	-	
- Land	-	-	
- Products	-	-	
- General waste treatment	kg Hg/y	0.08	
- Sector specific waste treatment	-	-	

2.4.4 Batteries with mercury

Batteries are among the largest product uses of mercury globally. Mercury is a very effective suppressor of zinc corrosion, which ultimately prevents the build-up of hydrogen, a potentially explosive gas, in various types of batteries. It is also used in

[13] Assumption made that all metal halide lamps imported contained mercury

high concentrations as a positive electrode in mercury-oxide (also called zinc-mercury) batteries (UNEP, 2017a).

Prior to 1997, mercury-oxide batteries were found in motorized equipment, hearing aids, watches, calculators, computers, smoke detectors, tape recorders, regulated power supplies, scientific equipment, pagers, and portable electrocardiogram monitors. Over the years, developed countries have banned or limited the use of mercury in batteries, and are now manufacturing batteries without intentionally added mercury content.

Mercury is still used in some button-cell shaped batteries of alkaline, silver oxide and zinc/air types that can be found in hearing aids, electronics, small toys and watches. The main mercury release pathways for batteries are through the atmosphere, land and general waste (UNEP, 2017a).

Batteries are not produced in Saint Lucia, but are imported. Batteries are imported mainly from the United States of America and the European Union. Due to the publication of the American National Standard for batteries in 2005, Mercury Containing and Rechargeable Act (1996) and the European Union's Battery Directive 2006, the majority of all batteries manufactured after 2006 are mercury free.

In Saint Lucia, batteries used for municipal and commercial use are not separated from general waste before disposal.

Data collection and assessment

Requests were made to Customs and Excise Department to assist in providing import data for 2015 and 2016 on the various types of batteries distinguished in the Global Harmonisation System Codes. Visits were made to various retailers of batteries in Saint Lucia. The mercury content of batteries imported in Saint Lucia is not known at this time. The default input factors for mercury content of batteries (taken from the Toolkit), range from 0.25 to 320 kg Hg per metric tonne.

There is no separate collection of batteries, and as such, used batteries end up in general waste. It is therefore assumed that the disposed batteries slowly release mercury into the atmosphere through gradual evaporation and slowly leach into the wastewater at the landfill as the battery encapsulations decay. The actual evaporation

or leaching of mercury may take several years or decades, as the decay of the battery encapsulation happens slowly.

The certainty of the data was assessed and shown in Table 24. Due to batteries being components of larger products that are imported into the country, it is likely that the actual number of batteries imported into the country was not fully captured by the Customs data used.

Table 24: Certainty assessment of the data estimates used for batteries with mercury

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Information received from Customs, however it is not known if the products contain mercury.
Input Data	Low	Based on the default factor used in the Toolkit spreadsheet.
Output Data	Medium	Based on Toolkit's default output distribution factors.

The following table (Table 25) summarizes the mercury inputs and releases to Saint Lucia from the use and disposal of mercury containing batteries during 2016.

Table 25: Summary of mercury releases from the use and disposal of batteries containing mercury imported in 2016

Use and Disposal of Batteries with Mercury	Unit	Use and Disposal		
		Mercury Oxide	Zinc-Air Button Cells	Silver Oxide Button Cells
Activity rate	t batteries/y	0.0001	0.000001	0.015
Input factor for phase	kg Hg/t batteries	320	12	4
Calculated input to phase	kg Hg/y	0.04	0.00	0.06
Output distribution factors for phase:				
- Air	-	-		
- Water	-	-		
- Land	-	-		
- Products	-	-		
- General waste treatment	N/A	1.0		
- Sector specific waste treatment	-	-		
Calculated outputs/releases to:				
- Air	-	-		

- Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	kg Hg/y	0.10
- Sector specific waste treatment	kg Hg/y	-

2.4.5 Polyurethane with mercury catalysts

Polyurethane is used in the manufacture of products including high resilience foam seating, high performance adhesives, surface coating and sealants, synthetic fibres, escalators, elevators and durable wheels for products such as shopping carts. The production of polyurethane materials may involve the use of organic mercury compound as a catalyst to harden or cure the polyurethane materials. The catalyst becomes embedded in the structure of the compound and remains in the final product (UNEP, 2017a).

There is a wide range of end products that contain polyurethane. Saint Lucia imports many of these products from various regions so it is difficult to trace every product back to its origin.

There is no special waste collection for polyurethane products and as such, these products are disposed with municipal and commercial waste at the designated landfills.

Data collection and assessment

As there is limited data on polyurethane consumption and use in Saint Lucia and globally, the Toolkit recommends using the national population and default input factors to calculate mercury emissions for polyurethane. Population data from 1996 was used in order to determine releases from historical disposal of this product. There is no local data on the mercury content of polyurethane and so the default input range was used. The certainty of the data was assessed and shown in Table 26.

Table 26: Certainty assessment of the data estimates used for polyurethane with mercury catalysts

Data Type	Assessment	Reason/Comment
Activity Data	Low	Based on the default factors for population data and electrification rate used in the Toolkit spreadsheet.
Input Data	Low	Based on the default factor used in the Toolkit spreadsheet.
Output Data	Low	Based on Toolkit's default output distribution factors.

Table 27 summarises the mercury input factors and releases via relevant pathways for electrical switches and relays determined.

Table 27: Summary of mercury releases from the use and disposal of polyurethane with mercury catalysts based on 1996 population data

Use and disposal of polyurethane with mercury catalysts	Unit	Use and disposal
Activity rate	inhabitants	149,004
Input factor for phase	g Hg/(y*inhabitant)	0.03
Calculated input to phase	kg Hg/y	4.38
Output distribution factors for phase:		
- Air	N/A	0.1
- Water	N/A	0.05
- Land	-	-
- Products	-	-
- General waste treatment	N/A	0.85
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	kg Hg/y	0.44
- Water	kg Hg/y	0.22
- Land	-	-
- Products	-	-
- General waste treatment	kg Hg/y	3.72
- Sector specific waste treatment	-	-

2.4.6 Cosmetics and related products with mercury

Skin Lightening Creams

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

Under the Minamata Convention, the manufacture, import and export of skin lightening creams with mercury contents greater than 1 ppm would not be allowed by Parties as of 2020.

The use of skin lightening creams has been found to be prevalent around the globe especially in African and Asian countries and Afro-diaspora regions like the Caribbean (Hamann, et al., 2014; Copan et al., 2015) where the trend of skin lightening has become prominent in beauty fads, culture and music. Further discussions on the social issues associated with skin lightening creams and the recommendations to address them are noted in Chapters 4, 5 and 6 of this report.

In Saint Lucia, the use of skin-lightening creams has been noted, but it is generally sold in informal settings, and is therefore difficult to quantify. While some skin-lightening products may be safe to use, many products on the global and local markets are unlabelled, mislabelled, counterfeit, or labelled in a foreign language. Therefore, the risk of using any of these products is increased as consumers are not able to identify their components (Zero Mercury Working Group, 2010). There is no data to confirm whether mercury-added cosmetics are imported and used in Saint Lucia, and more research is needed to determine the best approaches for determining whether these products are in use and for testing used products to determine whether it contains mercury.

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

2.5.1 Dental mercury-amalgam fillings

Dental mercury-amalgam is one of the materials that may be used to restore teeth with dental cavities. It is a mixture of liquid mercury and a powder containing silver, tin, copper, zinc and other metals (US EPA, 2016). Some dental facilities may prepare dental amalgam mixtures using the liquid mercury and powder directly with the use of an agitator; while the more common practice for placing dental amalgam fillings is through the use of small capsules, in which the mercury and the powder of other metals are pre-mixed in the right formula for immediate use in the clinic.

Dental preparation and procedures at dental offices

For the year 2016, there were approximately thirty-six (36) personnel who practiced dentistry in Saint Lucia. This includes volunteers from mission programs, general practitioners and dental specialists. Many of the private practice dentists have already phased out the use of dental mercury-amalgams and instead use composite material.

The powder form of dental amalgam was used in the past, but has been discontinued approximately since 2007 due to its hazardous content. Since then, the pre-encapsulated mercury has been used by both private and public sector dental personnel in Saint Lucia.

The procedure to create or remove an amalgam filling is similar within the public and private sector. To create an amalgam filling, the pre-encapsulated mercury is fed into a machine that mixes the amalgam powders. The filling is then poured into the dental caries. In the case of broken fillings, a high speed drill may be used to remove the remaining amalgam from the tooth and in other cases, a trough is made in the tooth and the entire amalgam structure is removed from the tooth as a whole mould.

According to interviews with private sector dentists by the National Project Coordinator, the use of composite is preferred, as mercury amalgams usually require a mechanical

retainer, which may be larger than the initial dental cavity. Composites, on the other hand, fill in the dental caries without creating a larger cavity within the tooth.

According to a public sector official, the mercury amalgam is used primarily in posterior teeth as it is more resistant to the grinding and gnashing of these teeth. The mercury-amalgam is also used in deeper cavities for longevity. Mercury amalgams are said to last approximately 10-15 years whereas composites may deteriorate quicker. Some patients may have some sensitivity to the composite material and are given the option of using the mercury amalgam. Composites are more costly than mercury-amalgam, therefore phasing out mercury amalgam completely from the public sector may have significant social implications.

Use of dental amalgam

There are only six (6) public dental clinics in the island of Saint Lucia, namely, in Gros Islet, Babonneau, La Clery, Soufriere, Vieux Fort and Dennery. It was also noted that the load of amalgam used at these clinics are very low. Of the patients seen at these clinics, on average, 20% require removal or changing of fillings and approximately 30-40% require dental amalgam fillings.

In contrast to private sector practitioners, public sector dental practitioners prefer using mercury amalgam as it is less costly and thus easier to apply to a large section of the public.

Disposal of dental amalgam

Any residue left after the pre-encapsulated dental amalgam filling procedure is placed into a special container and disposed of as biohazardous waste. Biohazardous waste is specially collected by the SLSWMA and is autoclaved before encapsulating with concrete. In regards to the removal and changing of dental amalgam fillings, the residue is sucked through a pipe that is connected to the building's wastewater system.

The majority of all dental personnel have chairs with reusable traps that collect the larger pieces of amalgams and other materials. The large pieces are disposed of in biohazardous waste.

Data collection and assessment

Questionnaires and interviews were conducted with dental practitioners, both private and public sector, as well as dental officials in the Ministry of Health and Wellness.

There is no local data on the number of amalgam fillings prepared annually; therefore an estimate was used based on the default input factors from the Toolkit.

The use of the powder form of dental amalgam may expose workers and clients within the operating room to elemental mercury vapour. Removal of amalgam via a high-speed drill results in the majority of the elemental mercury becoming vaporised and released to the atmosphere. The residue that is sucked through pipes will eventually find its way to a wastewater treatment plant or to drains leading directly to the ocean.

Reusable traps are often washed in dental sinks that contain mesh filters to help prevent the disposal of amalgam and other dental materials into the wastewater system. The mesh filters are disposed similar to the fillings residue, where they are placed into a special container and collected by the SLSWMA and disposed of as biomedical waste. However; some amalgam may pass through the mesh filters and leak into the wastewater system.

Mercury may also be released from fillings whilst still in the client's mouth, but this takes place at very low rates. They may be transferred to waste water treatment systems or sewer systems through faeces and urine.

Population data provided by the World Bank was used to determine the activity data used. An assessment of the certainty of the data provided is shown in Table 28.

Table 28: Certainty assessment of the data estimates used for dental mercury-amalgam fillings

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Based on population data and number of dentists.
Input Data	Low	Based on the default factor used in the Toolkit spreadsheet.
Output Data	Medium	Based on Toolkit's default output distribution factors.

The data entered is provided in Table 29. As the prevalence of mercury dental amalgam has been low according to persons consulted, it is likely that the estimated mercury releases is an over-estimation.

Table 29: Summary of mercury releases from dental mercury amalgam fillings

Dental Mercury Amalgam Fillings	Unit	Preparation	Use	Disposal
Activity rate	Inhabitants	178,015 (2016)	165,407 (2006)	149,004 (1996)
Input factor for phase	g Hg/(y*inh.)	0.15	0.15	0.15
Calculated input to phase	kg Hg/y	27	25	22
Output distribution factors for phase:				
- Air	N/A	0.02	-	-
- Water	N/A	0.14	0.02	0.3
- Land	N/A	-	-	0.08
- Products	N/A	-	-	0.06
- General waste treatment	N/A	0.12	-	0.08
- Sector specific waste treatment	N/A	0.12	-	0.08
Calculated outputs/releases to:				
- Air	kg Hg/y	0.54	-	-
- Water	kg Hg/y	3.78	0.50	6.16
- Land	kg Hg/y	-	-	1.76
- Products	kg Hg/y	-	-	1.32
- General waste treatment	kg Hg/y	3.24	-	1.76
- Sector specific waste treatment	kg Hg/y	3.24	-	1.76

2.5.2 Manometers and gauges with mercury

Mercury is used in some blood pressure gauges, pressure valves, industrial and meteorological manometers. Mercury was popularly used due to the high density and its effectiveness in responding to various pressure changes (UNEP, 2017a). The majority of mercury-containing devices are sphygmomanometers and blood pressure gauges. Non-mercury alternatives exist for all uses and are gradually being substituted for the mercury-using equivalents in some countries.

According to medical officials, the use of mercury containing devices are reducing every year due to hazardous concerns for mercury contamination and poisoning. Alternatives

such as digital blood pressure gauges are more common in medical institutions and for personal use.

Data collection and assessment

Questionnaires were given to various medical equipment suppliers to collect data on the number of manometers and other gauges that were sold or received during the year 2016. While some data on blood pressure gauges was received, data on other manometers and gauges could not be determined. Therefore, default calculations based on population data and electrification rates were used to estimate mercury releases from this sector. A certainty assessment of the data used for this sub-category is shown in Table 30.

Table 30: Certainty assessment of the data estimates used for manometers and gauges with mercury

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Medical manometers and gauges data based on 2016 imports while other manometers based on population data and default calculations.
Input Data	Low	Based on the default factor used in the Toolkit spreadsheet.
Output Data	Medium	Based on Toolkit's default output distribution factors.

It was determined that while manometers were in use, their impact on mercury releases were minimal based on the results (Table 31). More research should be conducted to determine the actual number of manometers and gauges in use in the country in order to assess mercury impacts from this sector more accurately.

Table 31: Summary of mercury releases from the use and disposal of manometers and gauges with mercury

Use and Disposal of Manometers and Gauges with Mercury	Unit	Use and Disposal	
		Medical Manometers and gauges	Other Manometers and gauges
Activity rate	inhabitants	-	178,015
	Items/y	8	-
Input factor for phase	g Hg/item	80	-
	g Hg/y*inhabitant	-	0.005
Calculated input to phase	kg Hg/y	1	1
Output distribution factors for phase:			
- Air	N/A	0.1	0.1
- Water	N/A	0.3	0.3
- Land	-	-	-
- Products	-	-	-
- General waste treatment	N/A	0.3	0.6
- Sector specific waste treatment	N/A	0.3	-
Calculated outputs/releases to:			
- Air	kg Hg/y	0.10	0.10
- Water	kg Hg/y	0.30	0.30
- Land	-	-	-
- Products	-	-	-
- General waste treatment	kg Hg/y	0.30	0.60
- Sector specific waste treatment	kg Hg/y	0.30	-

2.5.3 Laboratory chemicals and equipment with mercury

Mercury is used in laboratories as instruments, reagents, preservatives and catalysts, such as mercury electrodes. Most of the mercury is released into waste water and general waste, but some may be released to the atmosphere via laboratory vents (UNEP, 2017a).

Mercury has also been commonly used in thermostat equipment, whether as a component in electrical switches or as a major component for the thermostat function. For example, mercury may be used in “accustat” thermostats to switch on and off the electrical flow or in mercury thermostat probes (UNEP, 2017a).

Use of laboratory chemicals and equipment

In Saint Lucia, laboratory chemicals and medical devices are imported from various countries and regulated by the Pharmacy Council within the Department of Health and Wellness. Chemicals noted in the Drug Prevention of Misuse Act of 1988 and Narcotics Act of 1977 require special licenses for importation into the country. Chemicals imported into the country are red-flagged by Customs and invoices/chemical information are sent to the Drug Inspector's Office for review and approval.

Data collection and assessment

Questionnaires were sent to various laboratories, Water and Sewerage Company of Saint Lucia (WASCO), the Ministry of Health and Wellness and the Customs and Excise Department to inquire about the various uses of mercury reagents and chemicals as well as equipment containing mercury and their purposes in the laboratory. Table 32 indicates the mercury containing chemicals found in Saint Lucia based on received data.

Table 32: Summary of mercury laboratory chemicals and equipment

Mercury-Containing Source	Chemical/Equipment Present	Numbers consumed annually (g/yr)
Chemical Reagent	Mercuric Potassium Iodide (Nessler Reagent)	3,000
	Mercuric (II) Nitrate Monohydrate	200
Equipment	None	None

As the Toolkit spreadsheet uses default calculations to estimate the mercury releases from laboratory chemicals and equipment, the 2016 population data was used in the calculation. As no equipment was confirmed to be used in Saint Lucia, estimations were only made for laboratory chemicals. Table 33 shows the certainty of data based on the input used.

Table 33: Certainty assessment of the data estimates used for laboratory chemicals

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Based on default calculations.
Input Data	Low	Based on the default factor used in the Toolkit spreadsheet.
Output Data	Medium	Based on Toolkit's default output distribution factors.

Table 34 indicates the mercury input and output factors for laboratory chemicals with mercury.

Table 34: Summary of mercury releases from the use and disposal of laboratory chemicals in 2015

Use and Disposal of Laboratory Chemicals with Mercury	Unit	Use and Disposal
		Laboratory Chemicals
Activity rate	inhabitants	178,015
Input factor for phase	g Hg/y*inhabitant	0.01
Calculated input to phase	kg Hg/y	1.78
Output distribution factors for phase:		
- Air	-	-
- Water	N/A	0.33
- Land	-	-
- Products	-	-
- General waste treatment	N/A	0.33
- Sector specific waste treatment	N/A	0.34
Calculated outputs/releases to:		
- Air	-	-
- Water	kg Hg/y	0.59
- Land	-	-
- Products	-	-
- General waste treatment	kg Hg/y	0.59
- Sector specific waste treatment	kg Hg/y	0.61

2.5.4 Mercury metal use in religious rituals and folklore medicine

Elemental mercury has been known to be used for protection against spiritual forces, particularly in some traditional religions. It is said that persons inject it into their bodies or have vials around their property. Medical personnel in Saint Lucia have reported cases where persons have been denied the use of syringes or certain medicines due to their previous injection of elemental mercury. It is not known how many persons conduct these spiritual uses as these religions are considered taboo and not publicly practiced. The practice is diminishing as the population understands the harmful effects of mercury to the human body. In the past, it was noted that persons would request mercury from jewellers, who stocked it for use in the cleaning of gold for custom-made jewellery. Some jewellers have reported that these cases are currently non-existent or very limited.

2.6 Data and Inventory on Waste Incineration and Burning

As of 2015, there was no known incineration of municipal, general, hazardous or sewage sludge waste in Saint Lucia. Approximately 15 years prior, there was one (1) medical incinerator at the main public health hospital – Victoria Hospital; however, this is no longer in use and there are no known facilities for incineration of medical waste in the country.

2.6.1 Informal waste burning

This is defined as the burning of waste under informal conditions including barrels, containers and bare land with no emission controls and the diffuse spreading of incineration residues on land. Mercury releases associated with this type of incineration will be partly in air and waste residues. The waste residues can be subjected to further releases to the air, ground waters and surface waters (UNEP, 2017a).

Many private households practice open waste burning, more specifically with green waste. The main landfills do not practice open waste burning, however; due to the combustibility of green waste, particularly in the dry season, uncontrolled open fires may occur. This is a rare occurrence and has only been recorded twice in more than five (5) years.

Data collection and assessment

Questionnaires regarding the occurrence and practice of open waste burning were sent and collected from the main landfills in Saint Lucia: Deglos and Vieux Fort Landfills. Interviews with members of the SLSWMA were conducted, and previously published data was collected. According to research by Hoornweg and Bhada-Tata (2012), 4% of the total amount of waste generated per year in Saint Lucia is burnt informally, which resulted in 3,305 tonnes of waste. This estimation was used in the inventory.

No local data on the mercury content of waste is available; therefore the Toolkit defaults were used. The Toolkit contains no specific mercury content for informally burnt waste, but the estimated composition of waste burned in this manner was taken into consideration. Green waste is primarily incinerated in this practice; therefore the mercury content for burning biomass used in the Fuels and Energy Category of 0.03 g

Hg per tonne was applied. An assessment of the certainty of the data received is provided in Table 35.

Table 35: Certainty assessment of the data estimates used for informal waste burning

Data Type	Assessment	Reason/Comment
Activity Data	Low	Based on estimations inferred by previous research.
Input Data	Low	There is no local mercury content data for waste and so the lower default input data from the Toolkit was used.
Output Data	Low	Estimates are based on default output distribution factors from the Toolkit.

Table 36 provides a summary of the inputs and estimated releases of mercury due to the informal dumping of waste for Saint Lucia.

Table 36: Summary of mercury releases from the informal burning of waste in 2012

Informal Burning of Waste	Unit	Burned
Activity rate	t waste burned/y	3,305.2
Input factor for phase	g Hg/t waste burned	0.03
Calculated input to phase	kg Hg/y	0.10
Output distribution factors for phase:		
- Air	N/A	1.0
- Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	kg Hg/y	0.10
- Water	-	-
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

2.7 Data and Inventory on Waste Handling

2.7.1 Controlled landfills/deposits

Currently, Saint Lucia has two (2) functioning controlled landfills that are regulated by the Saint Lucia Solid Waste Management Authority (SLSWMA). The SLSWMA was established by the Waste Management Act (Chapter 6:05).

Deglos Sanitary Landfill

The Deglos Sanitary Landfill is the main landfill and the only sanitary landfill serving the commercial and residential community of the north, central and some parts of the south of the island. It is located in Bexon, the south-east quarter of Castries and was commissioned in March 2003. The landfill was constructed to replace the Ciceron disposal site which was the main disposal site for the north of the island. The main types of waste deposited at Deglos are Municipal Solid Waste (MSW), commercial and hotel waste, and green waste (Table 37).

Table 37: Summary of waste deposited in the Deglos Landfill in 2015

Waste Category	Amount Deposited in Deglos Landfill (%)
Residential/Institutional	40.5
Commercial	14.4
Green	11.2
Hotel	10.6
Construction and Development	6.3
Coconuts	3.7
Street Cleaning	3.5
Other (ship, tyres, beach cleaning etc)	9.8
Total Waste	51,661 tonnes

The Deglos Sanitary Landfill was constructed with a layer of clay and geo-membrane lining which collects leachate in low points called sumps, and the leachate is then pumped to the leachate ponds. There are three (3) ponds for the treatment and aeration of the leachate before it is discharged into the water stream leading to the Cul-De-Sac Bay. According to SLSWMA, leachate is occasionally monitored for heavy metals and other parameters by the Caribbean Public Health Agency (CARPHA). Recent monitoring tests concluded that mercury in the leachate is below the limit standard of 0.05 mg/l.[14]

There are six (6) main sorting stations within the landfill: MSW, green waste, biomedical waste treatment facility, waste oils, tyres and derelict vehicles. MSW is placed in sections of the landfill called cells. These cells are filled with waste and are regularly covered with a layer of granular soil. Once a cell is considered 'complete', it is deemed inactive, and a new area becomes the 'active' cell for waste deposition. Green waste is collected monthly by private contractors and may consist of yard and tree trimmings. These are deposited on a demarcated area in the landfill and left to decompose. Biomedical wastes including sharp instruments, pharmaceutical products, pathological and anatomical waste are autoclaved at a temperature of 138°C and a pressure of 380 kilo-pascals for approximately 10 minutes. The waste is then encapsulated in concrete and undergoes burial in a designated area of the landfill at a depth of at least 1.8 metres. Waste oil is collected and recycled to third party companies that require the use of boilers at their facilities. Tyres are shredded in smaller pieces via a tyre shredder and are either sent to recyclers or used as part of the boundary line for the landfill. Parts of derelict vehicles such as lead-acid batteries and various metal parts are sent to businesses located near the landfill for further recycling. The landfill has a capacity to receive waste for 20 years, but may continue to receive waste after that time.

Vieux Fort Landfill

The Vieux Fort Disposal Site was initially an open dump but was converted into a controlled landfill for residents in the south of the island. It is located in a former sand gravel pit and covers an area of 74,000 square metres.

[14] Monitoring tests for the last 5 years averaged mercury concentration at 0.00003 mg/l (data obtained from SLSWMA)

According to the SLSWMA (2015), the main types of waste deposited at this site are MSW, bulky waste and green waste, similar to the waste deposited at the Deglos Sanitary Landfill (Table 38).

Table 38: Summary of waste deposited in the Vieux Fort Landfill in 2015

Waste Category	Percentage Deposited in Vieux Fort Landfill (%)
Residential/Institutional	59.2
Commercial	11.7
Bulky Waste	5.2
Street Cleaning	6.1
Green	6.1
Hotel	4.5
Other (tyres, construction and development, coconuts, beach cleaning etc)	7.2
Total Waste	20,228 Tonnes

There are three (3) sorting stations within the landfill for: green waste, MSW and bulky waste. Much of the electronic appliances are informally recycled by residents and the unusable pieces are deposited at the landfill.

There are no designated leachate ponds however, 3 ponds in close proximity to the landfill are occasionally monitored for various parameters but not heavy metals.

Data collection and assessment

Questionnaires and interviews regarding waste deposition were conducted with various officials from the SLSWMA. Further information regarding waste deposition and composition was gathered from various publications and internet sources.

There is no local data for mercury content in waste, therefore the default input factor range, based on the Toolkit, of 5 grams of mercury per tonne of waste, was used.

The range's low-end factor applies to situations where a substantial part of the high mercurial content waste such as medical waste and batteries, is separated from the municipal waste for further treatment. The high-end factor applies to situations where no sorting takes place and therefore high mercurial content waste is present in municipal waste.

The SLSWMA encourages separation of medical and hazardous waste from general waste but as noted in other categories, much of that waste is incorporated into general waste due to breakages and other circumstances. Therefore, Saint Lucia's situation may be considered intermediate.

There are no emission controls at either of the landfills. Based on the default output distribution factors from the Toolkit, 1% of all mercury found in products and otherwise is released to the atmosphere annually and 0.01% forms part of the leachate that is released into nearby water bodies.

Test of waste default factors

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

The test made for general waste compares the calculated inputs to all four general waste subcategories; i.e. controlled landfills/deposits (E68[15]), informal waste burning (E66), and informal dumping of general waste (E71), with the sum of general waste outputs from the intentional use of mercury in products and processes (J42 to J56) as follows, using data from the Inventory Level 2 Spreadsheet.

In the spreadsheet, the test was done as follows;

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

18.6 kg > 2*(26.79 kg)

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

The derived expression is false as 18.6 kg is less than 53.58 kg. Therefore, the calculations made indicate that the default input factor for general waste treatment is not an over-estimation of the mercury releases from this sub-category. It is important to note, however; that there are data gaps for mercury releases from several categories of products and processes, and the quantities of general waste disposed through incineration of municipal/general waste, informal waste burning, and informal dumping were not determined. This assessment should be redone when new information is obtained. An assessment of the certainty of the data received is provided in Table 39.

Table 39: Certainty assessment of the data estimates used for waste deposition and landfilling

Data Type	Assessment	Reason/Comment
Activity Data	High	This is based on information in 2014 from the SLSWMA Annual Report 2014/15.
Input Data	Low	There is no local mercury content data for waste and so the default input data from the Toolkit was used.
Output Data	Medium	Estimates are based on default output distribution factors from the Toolkit.

It may be useful to monitor gas emissions and leachate regularly, to have more accurate estimates of the amount of mercury released to the atmosphere and water annually.

Table 40 provides a summary of the inputs and estimated releases of mercury due to waste landfilling for Saint Lucia.

Table 40: Summary of mercury releases from waste deposition and landfilling in 2014

Controlled Landfills/Deposits	Unit	Deposition
Activity rate	t waste landfilled/y	71,889
Input factor for phase	g Hg/t waste dumped	5
Calculated input to phase	kg Hg/y	359
Output distribution factors for phase:		
- Air	N/A	0.01
- Water	N/A	0.001

Controlled Landfills/Deposits	Unit	Deposition
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	kg Hg/y	3.59
- Water	kg Hg/y	0.04
- Land	-	-
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

2.7.2 Diffuse deposition under some control

This sub-category refers to deposition of special types of waste such as construction material under controlled procedures and with some retention of pollutants from wash-out, for example, incineration residues and other solid residues. This includes wastes which are often produced in very large quantities (UNEP, 2017a).

In Saint Lucia, incineration ash from cruise ships that visit the Castries Harbour is collected and transported to the main sanitary landfill, where it undergoes deep burial, a similar process to medical and hazardous waste. In SLSWMA's annual report 2014/2015, ship waste is noted as part of the waste deposited in the landfills. Ship waste can consist of incineration ash, old furniture and other general waste, thus quantifiable data for incineration ash is not known.

2.7.3 Informal dumping of general waste

This relates to disposal of general waste in the absence of safeguards preventing the release of pollutants into the environment (UNEP, 2017a). Informal dumping is considered an illegal act and is subjected to fines under the Waste Management Act (Chapter 6:05), enforced by the SLSWMA.

Residential, green and construction waste represent the major waste types dumped. Informal dumping in inconspicuous places, including dry ravines, was observed during

visits to potentially contaminated sites. It is unknown whether this practice presents a potential mercury danger to groundwater or the local community.

Data collection and assessment

Visits were made to common informal dumping sites across Saint Lucia and interviews on informal dumping were held with officials from the SLSWMA. As mentioned in the previous section, Hoornweg and Bhada-Tata (2012) stated that 13% of waste is uncollected, leaving 87% of waste being sent to the controlled landfills. Interviews with various solid waste officials estimate that of the 13% uncollected, 9% is informally dumped. Three quarters of the waste informally dumped is assumed to be green waste. Estimations of the volumes of waste are shown in Table 41.

There is no local data for mercury content in waste, but as research suggested that the majority of waste dumped is green waste, it is assumed that the mercury input factor would be low, therefore a lower input factor range, based on the Toolkit, of 2 grams of mercury per tonne of waste, was used. Local data on mercury content in residential and green waste would be necessary to calculate more accurate mercury inputs and outputs. Recent data on the percentage of waste uncollected allocated to informal dumping will also assist in more accurate data.

Table 41: Estimated amounts of waste informally dumped and informally burned based on assessments by Hoornweg and Bhada-Tata, 2012

Amount of waste landfilled, t/y (as determined in Section 2.3.1.1) [87% of total waste generated]	Amount of waste estimated to be informally dumped, t/y [9% of total waste generated]	Amount of waste estimated to be informally burned, t/y [4% of total waste generated]	Total amount of waste estimated to be generated, t/y [100%]
71,889	7,437	3,305	82, 630

An assessment of the certainty of the data received is provided in Table 42.

Table 42: Certainty assessment of the data estimates used for informal dumping of waste

Data Type	Assessment	Reason/Comment
Activity Data	Low	Based on estimations inferred by previous research.
Input Data	Low	There is no local mercury content data for waste and so the lower default input data from the Toolkit was used.
Output Data	Low	Estimates are based on default output distribution factors from the Toolkit.

Table 43 provides a summary of the inputs and estimated releases of mercury due to the informal dumping of waste for Saint Lucia.

Table 43: Summary of mercury releases from the informal dumping of waste in 2012

Informal Dumping of Waste	Unit	Deposition
Activity rate	t waste dumped/y	7,436.8
Input factor for phase	g Hg/t waste dumped	2
Calculated input to phase	kg Hg/y	15
Output distribution factors for phase:		
- Air	N/A	0.1
- Water	N/A	0.1
- Land	N/A	0.8
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-
Calculated outputs/releases to:		
- Air	kg Hg/y	1.49
- Water	kg Hg/y	1.49
- Land	kg Hg/y	11.90
- Products	-	-
- General waste treatment	-	-
- Sector specific waste treatment	-	-

2.7.4 Wastewater system/treatment

Saint Lucia has three main sewerage systems managed by the Water and Sewerage Company of Saint Lucia (WASCO).

Rodney Bay Treatment Centre

This sewerage system is located in the north of the island and serves a residential and commercial population of approximately 4,000 people. It is an advanced integrated pond system that allows sewage to be screened before going through four (4) lagoons, two (2) of which are equipped with surface aerators. Treated effluent from the system is discharged via an earth drain to a ravine which leads to the ocean on the East Coast of Saint Lucia. It is considered to be underutilized, working at 40% capacity.

Sewage sludge

Sewage sludge is the product of any wastewater treatment processes regardless of its origin such as, wastewater from municipal, agricultural or industrial activities. Sewage sludge contains trace amounts of mercury as a result of dental amalgams and ingested substances contaminated with mercury.

Many households/businesses in Saint Lucia use individual on-sites systems such as pit latrines, septic tanks and “soak-aways”. Sewage sludge is often removed from these systems by a private contractor and transferred to the Rodney Bay waste water treatment plant. The sludge is emptied into sludge pits at the plant. When the sludge pits are filled, the sludge is deposited onto the banks and becomes reintegrated into the soil.

The Rodney Bay Waste Water Treatment Centre is a biological treated lagoon system that requires little desludging. The last desludging took place over the years 2013 and 2014 however, the amount was not quantified.

Castries Sewerage System

This sewerage and disposal system serves 15% of the residential population in Castries and the commercial population in the city centre. It is assumed to work at 70% efficiency and all untreated waste water is collected in this system and is released through a sump pump located in the Castries Harbour.

Black Bay Treatment Plant

The Black Bay Treatment Plant is a small sewerage system located in the south of the island and was recently acquired in 2015. Information received from WASCO indicated that the treatment plant has 2 separate wastewater systems; the Black Bay Development sewer system and the St. Jude Hospital sewer system. Treatment is provided for the Black Bay system while there is no treatment for the St. Jude Hospital system. Additionally, there is no means of measuring the flow from the St. Jude Hospital system, however; it is estimated that the flow would be the same as the Black Bay Development system.

Data collection and assessment

Questionnaires regarding the amount of wastewater treated per year and the amount of sludge removed were sent to WASCO officials. Information regarding wastewater treatment in Saint Lucia was gathered from various publications.

There is no local data for mercury content in wastewater and as such, the default input factors based on the Toolkit were used. Whilst the consumption of certain mercury products is declining, many products containing mercury are still being used. These products may release mercury directly into the wastewater stream as much of the grey water from residential and commercial buildings is generally discharged to open drains, which will eventually make its way to a waterway or the sea. Considering all those factors, Saint Lucia's situation with regards to mercury in wastewater can be considered to be intermediate and as such, a default input factor range of 5.25 mg Hg/m^3 wastewater was used.

There are no emission controls for mercury compounds in the wastewater system. Based on the default output distribution factors from the Toolkit, it is assumed that all mercury will be released to waterways if there is no treatment and is directly released from sewer pipes. This applies to the Castries Sewerage System. In Saint Lucia, all landfills prohibit the depositing of any sludge material. Therefore, it is assumed that all mercury is released to the waterways.

Test of wastewater default factors

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

The test made for wastewater compares the calculated inputs to wastewater treatment (E72[16]) with the sum of relevant outputs to water from the intentional use of mercury in products and processes (G42 to G56) as follows, using data from the Inventory Level 2 Spreadsheet.

In the spreadsheet, the test was done as follows;

Tab "Level 2-Summary": E72 > 2*(Σ(G42 to G56))

17.00 kg > 2*(11.88 kg)

The calculations made indicate that the default input factor for wastewater treatment does not necessarily over-estimate the mercury releases from these sub-categories. It is important to note, however; that there are data gaps for mercury releases from several categories of products and processes, and this assessment should be redone when new information is obtained. Assessment of estimates made for wastewater treatment systems sub category is shown in Table 44.

Table 44: Certainty assessment of the data estimates used for wastewater system/treatment

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Rodney Bay WWTP and Black Bay Development sewer system from WASCO's records. Estimated data for Castries system and St Jude Hospital.
Input Data	Low	There is no local data for mercury content in wastewater, the default input data from the Toolkit was used.

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

Data Type	Assessment	Reason/Comment
Output Data	Low	Estimates are based on default output distribution factors from the Toolkit, with the output scenario based solely on the information received for Rodney Bay's WWTP which indicated that mechanical and biological (activated sludge) treatment; with some sludge used for land application were the main outputs.

Table 45 summarizes the mercury inputs and releases to Saint Lucia from wastewater systems and treatment. Further data on the operations of all of the wastewater treatment systems is necessary to better inform the releases from this sector.

Table 45: Summary of mercury releases from the operation of wastewater systems/treatment

Wastewater System/Treatment	Unit	Operation of wastewater systems
Activity rate	m^3 wastewater/y	3,188,596
Input factor for phase	mg Hg/m^3 waste	5.25
Calculated input to phase	kg Hg/y	17
Output distribution factors for phase:		
- Air	-	-
- Water	N/A	0.5
- Land	N/A	0.2
- Products	-	-
- General waste treatment	N/A	0.15
- Sector specific waste treatment	N/A	0.15
Calculated outputs/releases to:		
- Air	-	-
- Water	kg Hg/y	8.50
- Land	kg Hg/y	3.40
- Products	-	-
- General waste treatment	kg Hg/y	2.55
- Sector specific waste treatment	kg Hg/y	2.55

2.8 Crematoria and Cemeteries

Mercury may be released from crematoria and cemeteries due to the presence of dental amalgam fillings in the corpses' teeth and a small percentage from mercury accumulation in the body tissue through fish consumption and other exposure pathways (UNEP, 2017a). Mercury is released primarily to the air from crematoria and land for cemeteries. In 2014, there were approximately 1,322 deaths registered in Saint Lucia according to the Central Statistics Office (CSO); 59 were cremated and 1,263 are assumed to be buried in cemeteries[17].

There is no information on the mercury content of corpses in Saint Lucia; however, mercury content can be estimated based upon expert observations of corpses. According to various undertaker sources, many of the corpses are above the age of 50 and may contain an average of 2-3 dental amalgam fillings. Table 46 shows the estimated mercury content of a body corpse based upon expert observations and the Toolkit.

Table 46: Estimated mercury content in corpses

Number of Deaths	Mercury Content in filling (g)	Estimated Number of Dental Amalgam Fillings per corpse	Average Mercury Content per corpse (g)	Total Mercury Content Released from Corpses in 2014 (g)
1322	0.8	3	2.4 (0.8g x 3fillings)	3,172.80 (1322corpes x 2.4g)

2.8.1 Crematoria

There is one (1) private crematorium in Saint Lucia located in the south of the island and all cremations are done at this site. It is considered relatively cheaper than burials, and is becoming increasingly popular. Over the past 5 years, the number of cremations held in Saint Lucia has tripled (RFP, 2017). The main mercury release pathway for crematoria is to air.

[17] Deaths are not recorded by method of burial, but by deaths registered. Some burials may have taken place overseas.

The crematory uses gasoline and reaches temperatures of 900 degrees Celsius (1,650 degrees Fahrenheit). A thermocouple is used to refract emission gases into a secondary chamber that breaks down and vaporises all gases. The clear vapour is released from a combustion stack above the crematorium.

According to the Burial and Cremation Act of Saint Lucia (2016), a cremation site must be located at least 90 meters away and an open pyre site should be located at least 2 kilometres away from any dwelling house. However, this section of the Act does not apply to any crematorium that was built and in use prior to the commencement of the Act. This means that the current crematorium is not bound by these guidelines; however, according to the crematorium operator; the emission release does not directly affect the few residential homes located near the crematorium.

The majority of all the mercury within the corpse will be vaporised during the cremation process. The elemental mercury found after the process, is usually in a ball-like form among the remaining bones. This mercury is transferred to the hazardous waste using strong magnets and disposed of by hired contractors. The disposal location of the collected mercury is not known (RFP, 2017). Even in this free-metal form, mercury is unstable and highly volatile, which may lead to further vaporisation to the atmosphere (Buschmann and Tsokos, 2014).

Table 47 shows the trend of cremations for the past 3 years in Saint Lucia. Cremations increased by 37% in 2015 and further increased by 12% in the following year.

Table 47: Summary of crematoria in Saint Lucia

Crematoria in Saint Lucia	Number of Cremations		
	2014	2015	2016
Rambally's Funeral Parlour Crematorium	59	81	91

2.8.2 Cemeteries

Cemeteries can be found in various areas; some are found near beaches, water ways, or on high and low elevations. There are no guidelines for the designation or development of a burial ground as per the Burial and Cremation Act.

Data collection and assessment

Questionnaires requesting burial and cremation data were sent to the 2 main branches of the funeral parlour responsible for the crematorium. An interview was also held with the crematorium's operator. Data for the number of deaths was requested from the Ministry of Justice and the CSO.

For more accurate information on burials, number of burials per year per cemetery would be needed. Attempts were made to collect burial information for the year 2016 per cemetery, however; many district councils, and other private organizations do not have electronic records. An assessment of the data used for this sector is shown in Table 48.

Table 48: Certainty assessment of the data estimates used for cremations and burials

Data Type	Assessment	Reason/Comment
Activity Data	Medium	Data was received from the Central Statistics Office and from the crematorium. However in terms of burials, it was assumed that the number of recorded deaths (minus the number cremated) were buried in Saint Lucia.
Input Data	Medium	Based on calculations done.
Output Data	Medium	Based on Toolkit's default output distribution factors.

Based on the data obtained, crematoria and cemeteries accounted for 3 kg of mercury releases in Saint Lucia as detailed in Table 49.

Table 49: Summary of mercury releases from crematoria and cemeteries

Crematoria and Cemeteries	Unit	Crematoria	Cemeteries
Activity rate	corpses cremated/y	59	-
	corpses buried/y	-	1263
Input factor for phase	g Hg/corpse	2.4	2.4
Calculated input to phase	kg Hg/y	0.142	3.031
Output distribution factors for phase:			
- Air	N/A	1.0	-
- Water	-	-	-
- Land	N/A	-	1.0
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-
Calculated outputs/releases to:			
- Air	kg Hg/y	0.14	-
- Water	-	-	-
- Land	kg Hg/y	-	3.03
- Products	-	-	-
- General waste treatment	-	-	-
- Sector specific waste treatment	-	-	-

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

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

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

Saint Lucia does not have any notable stocks of mercury and/or mercury compounds as the largest sources of mercury are due to the use and disposal of MAPs.

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

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

Based on the inventory, it was determined that no significant sources of (nor recycling activities of) mercury and mercury compounds are present in Saint Lucia and therefore the interim storage provisions outlined in Article 10 of the Minamata Convention are not applicable to Saint Lucia should they become a Party.

2.11 Impacts of Mercury on Human Health and the Environment

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

Methylmercury is a neurotoxin which can cause physiological harm and behavioral disorders in people. Therefore there is a need for further investigation into the quantities of mercury being released into the environment in order to fully understand what should be done to eliminate this toxic metal and reduce its impacts in Saint Lucia. Chapters 4 and 5 of this report detail further the risks of exposure to mercury by the population of Saint Lucia.

Chapter 3: Policy, Regulatory and Institutional Framework Assessment

An assessment of the policy, regulatory and institutional framework was conducted by a legal consultant hired under Component 2 of the MIA project, Dr Winston McCalla. The following has been extracted from Dr McCalla's Report, "Assessment of, and Recommendations for, the Legislative and Institutional Framework in Relation to the Implementation of the Minamata Convention on Mercury in Jamaica, Saint Kitts and Nevis, Saint Lucia and Trinidad and Tobago", 2018.

3.1 Assessment of Policies

This section deals with policies in Saint Lucia that are related to mercury or potentially related to mercury.

National Environmental Policy

In an effort to improve and strengthen environmental management in Saint Lucia, and in response to the implementation of the St. George's Declaration on Principles for Environmental Sustainability, the Cabinet of Ministers approved a National Environmental Policy (NEP) and National Environmental Strategy (NEMS) for Saint Lucia in October 2004. The NEP provides a broad framework for environmental management in Saint Lucia and establishes links with policies and programmes in all relevant sectors of development. However; there have been problems with implementation, enforcement and integration into government institutions and society in general due to the absence of clear mandates, lack of priority by law enforcement agencies and the judiciary, lack of awareness, and weak public ownership for promotion of resource conservation. The NEMS sets out specific actions and mechanisms for a most efficient policy implementation.

In the 2014 revision of the NEP and NEMS, eight (8) issues from the National Environmental Summary (2010) were identified as still being relevant. The issues with possible applicability to mercury are deterioration in air quality and pollution from liquid and solid waste. There is no mention specifically of mercury or its compounds within the document itself. However; there is mention of implementation of obligations under

chemicals and waste multilateral environmental agreements, including the Strategic Approach to International Chemicals Management under Outcome 4 which addresses improved systems for managing waste and controlling pollution. A public education activity on chemical management *inter alia* was also included under Outcome 6 in the revised NEP.

3.2 Assessment of Legislation

This Section reviews the legislation in Saint Lucia related to mercury or potentially related to mercury.

3.2.1 Existing Legislation

External Trade Act (Chapter 13:11)

The External Trade Act (Chapter 13:11) contains provisions related to the importation and exportation of goods. Under Section 3, the Minister may (by order published in the *Gazette* and in a newspaper circulating in Saint Lucia):

- prohibit the import of any class of goods from or originating in any country or place without a licence granted under Section 4; and
- prohibit absolutely or limit the importation of any goods if in his or her opinion such action is in the interest of the island and may for the same reason make by order any such imports subject to such conditions as he or she may think fit.

By Section 3, the Minister could prohibit the importation of mercury or mercury-added goods or control the importation of such goods. This would be done by way of a Statutory Instrument published in the *Gazette*.

It is recommended that the relevant Statutory Instrument could use the definition of mercury as contained in the Minamata Convention (Article 2(d)). The definition of mercury added products could also reflect the products listed at Annex A, Part 1 of the Minamata Convention.

Pesticides and Toxic Chemicals Control Act (Chapter 11:15)

The Pesticides and Toxic Chemicals Act (Chapter 11:15) was enacted to regulate pesticides and toxic chemicals and also to implement the Chemical Weapons Convention in Saint Lucia.

Under the Act, "pesticide" means any substance, whether toxic chemical or not, which is sold or used, for controlling or destroying pests. "Toxic Chemical" refers to any chemical, other than a pesticide, which, through its chemical action on life processes, can cause death, temporary incapacitation or permanent harm to humans or animals. This includes all chemicals, regardless of the origin or their method of production, and regardless of whether they are produced in facilities or otherwise.

The purpose of the Act is to regulate pesticides and toxic chemicals and to implement the obligations of Saint Lucia under the Chemical Weapons Convention, as articulated in Section 3. Mercuric chloride is scheduled as extremely hazardous (Schedule 5 of the Pesticides and Toxic Chemicals Control Act [Chapter 11:15]). [18]

Section 31 imposes a prohibition on the import or export of a pesticide or toxic chemical unless the:

a) importation or exportation is authorised by an import or export licence, and
b) pesticide or toxic chemical is packaged and labelled.

Section 32 provides that a person shall not operate premises in which any pesticide or toxic chemical is manufactured unless the:

a) person is so authorised by a premises licence issued in respect of the premises,
b) premises comply with the prescribed standards for the construction and operation of the premises
c) person complies with requirements for the storage, distribution, packaging and labelling of pesticides and toxic chemicals and any conditions that the Board may stipulate in the licence.

[18] It appears that mercuric acid was widely used as a medicinal treatment. It is no longer used as such. This may explain its inclusion. However placing the restriction on all mercury products will cover mercuric chloride as well.

The effect of the abovementioned Sections and Schedule 5 is that importation, exportation or manufacture of mercuric chloride would be prohibited subject to the qualifications set out in Section 31 (a) and (b) or Section 32 (a)(b)(c). Thus, there is no total ban on the importation, exportation or manufacture of mercuric chloride as for example an import or export licence (see Section 31(a)) can be procured to affect such importation. Also, Schedule 5 does not apply generally to mercury or MAPs.

Public Health Act (Chapter 11:01)

The Public Health Act (Chapter 11:01) establishes a broad legal framework for public health management in Saint Lucia. As stated in Section 3 of the Act, the Minister of Health is responsible for the promotion and preservation of the health of the inhabitants of Saint Lucia.

Under the Public Health Act (Chapter 11:01), the Minister's functions include:

- the prevention, treatment, limitation and suppression of disease, including the conduct of investigation and inquiries;
- the education of the public in the preservation of health;
- the abatement of nuisances and the removal or correction of any condition that may be injurious to the public health; and
- the control of food and drugs.

By Section 6, the Chief Medical Officer is empowered to discharge the functions of the Minister under the Public Health Act (Chapter 11:01).

The Act would be relevant to mercury issues in that all matters that impact health (for example, the impact of mercury on health) would fall within the preview of this Act. Article 16 of the Minamata Convention on Mercury promotes programme development related to the health aspects of mercury and recognise that the activities will involve public health ministries and stakeholders involved in the delivery of health service. Article 16 provides guidance to health ministries on the activities they can undertake to minimize mercury exposure.

Article 16 essentially deals with policy matters and providing guidance to the Ministry responsible for health. The Minister's functions under the Public Health Act are wide enough to facilitate the implementation of Article 16 in Saint Lucia. There would be no need to amend the Public Health Act (Chapter 11:01).

Waste Management Act (Chapter 6:05)

The objective of the Waste Management Act (Chapter 6:05) is "to provide for the management of waste in conformity with best environmental practices." However; the term "best environmental practices" is undefined in the Act.

Section 2 of the Act defines "hazardous waste" as meaning any material that belongs to any category specified in Annex I of Schedule I unless it does not possess any of the characteristics specified in Annex II of Schedule I. Annex I of Schedule I includes mercury compounds in the category of hazardous waste.

Section 5 of the Act requires the SLSWMA (established under Section 3) to compute an inventory and characterization of solid waste generated in Saint Lucia. Section 5(3) also requires the Solid Waste Authority to prepare a National Waste Management Strategy. This strategy shall include an implementation programme outlining mechanisms, programmes, policies and strategies that are to be established to ensure that waste management is carried out in such a manner so as not to adversely impact human health or the environment. Further, by Section 6(2) the implementation programme shall include, *inter alia*, standards, requirements and procedures for the management of all waste, including the generation, handling, storage, treatment, transport and disposal of all types of waste. The National Waste Management Strategy shall also identify methods by which hazardous waste (*which should include mercury waste*) and other specified classes of solid waste substances are to be managed.

Section 30(3) provides inter alia as follows, "no person shall import into Saint Lucia any hazardous waste other than waste governed by the Marine Pollution Act.

Water and Sewerage Act, 2005 (Chapter 9:03)

The Water and Sewerage Act (Chapter 9:03) provides for the management of water resources and regulates the delivery of water supply services.

Under Section 7, where on the recommendation of the Water Resources Management Agency (WASCO) (established pursuant to Section 3), the Minister concurs that the quantity or quality of water resources is threatened, the Minister shall:

a) cause to be carried out, such operations as he or she considers appropriate to prevent any matter from entering the water, or to remove or dispose of any matter and to remedy or mitigate any pollution caused by the presence of any matter in the water; and

b) immediately request the Minister of Health and any other Minister to take appropriate action in accordance with the law in force in Saint Lucia.

Pending the promulgation of specific regulations to address the release of mercury into the water supply as contemplated by Article 9 of the Minamata Convention, it is submitted that action may be taken pursuant to Section 7 of the Water and Sewage Act to address any pollution of the water supply by mercury.

Labour Act (Chapter 16.04)

The Labour Act consolidates and reforms the legislation applicable to labour and industrial relations taking into account both existing local standards and international labour law standards. Part IV of the Act deals with Occupational Health and Safety.

Section 169 of the Act provides that the provisions in respect of occupational health shall apply to every industrial establishment, to all owners and occupiers of industrial establishments, and to all employers and employees.

Under Section 236(1) where a chemical, physical or biological agent is used or is intended to be used in the workplace and its presence in the workplace or the manner of its use is likely to endanger the health of an employee, the Chief Occupational Safety and Health Officer shall in writing order that the use, presence or manner of use be:

a) prohibited;

b) limited or restricted in such manner as the Chief Occupational Safety and Health Officer specifies; or
c) subject to such conditions regarding administrative control and work practices, engineering control, and time limits.

By Section 237, except for purposes of research and development, a person shall not manufacture, distribute or supply for commercial or industrial use any new chemical or biological agent without giving notice to the Department of Labour.

Section 238 requires each employer to make and maintain any inventory of all hazardous chemicals and all hazardous physical agents that are present in the workplace.

Section 239 requires an employer to properly label all hazardous chemicals present in the workplace. In addition, by Section 239(3), an employer shall ensure that a hazardous chemical is not handled or stored at a workplace, unless the prescribed requirements (i.e. those designated by regulations) concerning identification, chemical safety data sheets and employee instructions are met.

Thus, the Labour Department may invoke Section 236 of the Labour Act to prohibit the manufacturing processes which are required to be completely phased out pursuant to Article 5(2) and Appendix B, Part 1 of the Minamata Convention. In the case of manufacturing processes which are to be regulated in accordance to Appendix B, Part II of the Minamata Convention, Section 236(2) of the Labour Act can be used to regulate these industries if relevant.

Standards Act (Chapter 13:25)

The Standards Act (Chapter 13:25) provides for the preparation and promotion of standards in relation to goods, services, processes and practices used and produced locally. The Act gives the Saint Lucia Bureau of Standards (SLBS) the responsibility to develop and promote standards for products and services for the protection of the health and safety of consumers and the environment, as well as for industrial development, in order to promote the enhancement of the economy of Saint Lucia.

Section 4 of the National Bureau of Standards Act sets out the functions of the Bureau and includes the following provisions:

a) standards setting;
b) testing laboratories;
c) certifying products, commodities and processes that conform to national standards; and
d) recognising as national standards any standards established by any other body approved by the Bureau.

Section 19(2)(a) of the Standards Act permits the SLBS to make compulsory standards intended "to protect the consumer or user against dangers to health or safety." Section 23 of the Act gives the SLBS the power to test articles to ensure that they comply with a compulsory standard. Sections 24 and 25 of the Act prohibit the sale, import and export of articles which do not comply with a compulsory standard.

Thus, under the existing legislation, the SLBS already has the power to promulgate standards relating to the mercury content of certain items in accordance with the requirements of the Minamata Convention. The SLBS may subsequently use its testing and enforcement powers to prohibit the circulation of goods found not in compliance with the Minamata Convention.

Customs (Control and Management) Act (Chapter 15:05)

Section 32 of the Customs (Control and Management) Act (Chapter 15:05) deals with the improper importation of goods. In Section 32(1) when goods are imported improperly in violation of Section 32(1), such goods are, subject to Section 32(2), liable to forfeiture.

Section 33(2) applies to where any goods, the importation of which is prohibited or restricted under or by virtue of any enactment are on their importation either:

a) reported as intended for exportation in the same vessel or aircraft;
b) entered for transhipment; or
c) entered to be warehoused for exportation or to use as stores.

Section 84(1) provides that no goods, class or description of goods, prescribed in Part I (Prohibited Imports) of the fourth Schedule shall be imported into Saint Lucia. Similar prohibitions are contained in Section 84(2), 84(3) and 84(4) in regard to goods prescribed in Part II (Restricted Imports), Part III and Part IV of the fourth Schedule respectively. By Section 84(5), the respective Minister may add, vary or amend the fourth Schedule.

Physical Planning and Development Act (Chapter 5:12)

The Physical Planning and Development Act (Chapter 5:12) governs the development of land in Saint Lucia. The Development Control Authority (DCA) is responsible for administering the Act. An application for permission to develop land must be submitted to the DCA. This includes applications for industrial plants or buildings. Although there is at present no industrial activity utilizing mercury in Saint Lucia the provisions of this Act would address this if it were to become relevant. Schedule 4 of the Act requires that an Environmental Impact Assessment be submitted to the DCA in respect of, "Any industrial plant which in the opinion of the Head of the Physical Planning and Development Division is likely to cause significant adverse environmental impact." The strategies to assess potentially mercury contaminated sites could be considered when conducting such Environmental Impact Assessments.

3.2.2 Minamata Convention and Saint Lucia Legislation

This section highlights some of the articles of the Minamata Convention on Mercury that relate to national legislation and may be relevant should Saint Lucia become a Party (Table 50).

Table 50: Overview of Minamata Convention provisions, and coverage by existing legislation in Saint Lucia

Article 2: Definitions	
Description of Article:	**Relevant Policy and Regulation Measures**
Defines relevant terms such as "mercury-added product" which means a product or product component that contains mercury or a mercury compound that was intentionally added".	This definition will need to be added to any legislation which is to be enacted or amended.
Article 3: Mercury supply source and trade[19]	
Description of Article:	**Relevant Policy and Regulation Measures**
This article deals with mercury supply sources and trade, not including mercury and mercury compounds used for laboratory purposes, naturally-occurring trace quantities or MAPs. Mercury supply sources covered under this article include primary mercury mining and decommissioning of chlor-alkali facilities.	- Under the MIA project, it was determined that none of the mercury supply sources and relevant trade stipulated under this article, are relevant to Saint Lucia. - If deemed relevant in the future, the External Trade Act (Chapter 15:11) could be utilized to prevent the import of mercury. The provisions of the Schedule 3 of Customs (Control and Management) Act (Chapter 15.05) could also be amended to prohibit the importation of mercury into Saint Lucia.
Article 4: Mercury-added products	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(1) Not allow the manufacture, import, and export of products listed in Part I of Annex A not otherwise excluded following the phase out date listed in the Annex[20] (3) Phase down the use of dental amalgam through two or more measures listed in Part II of Annex A	- Under the Pesticides and Toxic Chemicals Control Act (Chapter 11:15) (Section 31 and Schedule 5), only mercuric chloride is mentioned and there is no general reference to mercury and mercury-added products. In addition, by Section 31, an import permit may be granted or export may be permitted if the toxic chemical (mercuric chloride) is properly packaged and labelled. - Section 3 of the External Trade Act (Chapter 13:11) provides that the Minister may by Order prohibit the import of any class of goods without a licence granted under Section 4. If the provisions of the External Trade Act (Chapter 13:11) are utilized, the exercise of such provisions would fully meet the requirements of Article 4. - By Section 5(1)(a) of the aforementioned Act, the Minister may by Order prohibit the export to any country of any class of products without a licence. Also under Section 5(1)(b), the Minister may prohibit absolutely or limit the exportation from the country if in his or her opinion such action is in the interest of Saint Lucia or of any part of Her Majesty

[19] Since this checklist is primarily intended for developing countries, it is assumed that governments will desire control over individual mercury shipments entering the country and thus not provide a general notification of import consent or waive restrictions on the sources of mercury imports under Articles 3.7 and 3.9.
[20] The prohibition date must be consistent with Articles 4 and 6 of the Convention.

	dominions (i.e. the Commonwealth). In the case of a licence to export under Section 5(1)(9a), the quantity of a licence to export is in the discretion of the Permanent Secretary (Section 6).
	- Instead of taking appropriate measures to phase out the mercury-added products listed in Part I of Annex A, a Party may at the time of ratification or upon entry into an amendment to Annex A, indicate that it will implement the strategies to address products listed in Part I of Annex A (see Article 4(2)). To avail itself of Article 4(2) alternative a Party would have to demonstrate two matters:
	  o that it has already reduced to a minimal level the manufacture, import, and export of the large majority of the products listed in Part I of Annex A; and
	  o that it has implemented measures or strategies to reduce the use of mercury in additional products not listed in Part I of Annex A at the time it notifies the Secretariat of its decision to use this alternative.
	- Article 4(3) contains special provisions in respect of dental amalgam. By Article 4(3) each Party shall take measures for the mercury-added products listed in Part II of Annex A in accordance with the provisions set out therein. Part II of Annex A provides that measures to be taken by a Party to phase out the use of dental amalgam shall take into account the Party's domestic circumstances and relevant international guidance.
	- It is to be noted that none of the measures specified in Article 4(3) necessarily require legislative support. Given the broad scope and flexibility of the measures it is expected that Saint Lucia would be able to implement the provisions of Article 4(3). Part II of Annex A of the Minamata Convention on Mercury sets out the measures to be taken by a Party to phase out the use of dental amalgam.

Article 6: Exemptions available to a Party upon request	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
Article 6 states that a "State or regional economic integration organization may register for one or more exemptions from the phase-out dates listed in Annex A or Annex B…".	– If such exemptions are deemed necessary, the State must notify the Secretariat in writing, with an explanation, on becoming a Party to the Convention. Other stipulations for requesting exemptions are detailed in the Article.
Article 8: Emissions *Article 8 defines "emissions" as meaning emissions of mercury or mercury compounds to the atmosphere.*	

Description of Article:	Relevant Policy and Regulation Measures / Action:
Require control and, where feasible, reduce emissions of mercury and mercury compounds, often expressed as "total mercury" to the atmosphere through measures to control emissions from point sources falling within the source categories listed in Annex D	- While none of the Annex D sources are present in Saint Lucia, the provisions under this Article would have to be taken into consideration if any plans for these facilities develop in the future. There are no statutory provisions in Saint Lucia which deal with emissions. Draft Pollution Regulations were prepared in 2014 which would have introduced controls over emissions to air, however the Draft Pollution Regulations have yet to be implemented.
Article 9: Releases	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(5) Take one or more measures below to control/reduce mercury and mercury compound releases to land and water from significant sources it identifies: • release limit values to control and, where feasible, reduce releases from relevant sources; • the use of best available techniques and best environmental practices to control releases from relevant sources; • a multi-pollutant control strategy that would deliver co-benefits for the control of mercury releases; and • alternative measures to reduce releases from relevant sources	- Releases to water would be covered by the Public Health Act and more specifically Regulation 3 of the Public Health Act (Waste Quality Control). Regulation 3 prohibits the performance of any action which will impair the quality of water or any matter likely to be injurious to health. - Currently, there are no statutory provisions which deal with releases to land. The Draft Pollution Regulations prepared in 2014 would have dealt with releases to land but these draft Regulations have yet to be implemented.
Article 11: Mercury wastes	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(3)(a) Take measures to manage mercury wastes in an environmentally sound manner, taking into account guidelines developed under the Basel Convention and in accordance with COP requirements to be developed. (3)(b) Take measures to restrict mercury derived from the treatment or re-use of mercury waste to allowed uses under the Convention or environmentally sound disposal (3)(c) Require transport across international boundaries in accordance with the Basel Convention, or if the Basel Convention does not apply, consistent with international rules, standards, and guidelines	- Article 11(3)(c) requires that the transport of waste should be in accordance with the requirements of the Basel Convention of which Saint Lucia is a Party. - The Waste Management Act is relevant to the implementation of Article 11 as the Act prohibits the importation of hazardous waste into Saint Lucia. Further, it calls for the preparation of a National Waste Management Strategy. Under the Act this strategy shall include an implementation programme outlining mechanisms, programmes, policies and strategies that are to be established so that waste management is carried out in such a manner as not to adversely affect human health or the environment. Section 30(3) of the Waste Management Act (Chapter 6:05) provides that no person shall import into Saint Lucia any hazardous waste.
Article 12: Contaminated Sites	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**

(1) Develop strategies for identifying and assessing mercury/mercury compound contaminated sites	- There are no specific provisions governing contaminated sites however, under the MIA project, an assessment of potentially contaminated sites has been conducted in order to inform the Government of Saint Lucia. - The provisions of the article are not obligatory but are encouraged.
Article 16: Health Aspects	
Description of Article:	**Relevant Policy and Regulation Measures / Action:**
(1)(a) Promote the development and implementation of strategies to identify and protect populations at risk from exposure to mercury and mercury-based compounds (1)(b) Promote the development and implementation of educational programmes on occupational exposure to mercury and mercury compounds (1)(c) Promote appropriate healthcare services for prevention, treatment and care of populations affected by the exposure to mercury or mercury compounds (1)(d) Address the need to establish and strengthen the appropriate institutional and health professional capacities for the prevention, diagnosis, treatment or monitoring of health risks related to the exposure to mercury and mercury compounds	- The Public Health Act generally addresses health issues in by policies related to: • Public health; • Water; • Drinking water; • Food safety; • Occupational health and safety; and • Protecting general public vulnerable groups, and workers

3.2.3 Gaps

There are several gaps in Saint Lucia's existing policies and legislation regarding mercury and its environmentally sound management. These include the absence of:

1. Policy that deals with the management of mercury or MAPs or hazardous waste in general.
2. Specific legislation in compliance with Article 4 on MAPs.
3. Air pollution regulations to address Article 8.
4. Water pollution regulations to address Article 9.
5. Existing legislation for the implementation of the Basel Convention, which is also relevant for the export and disposal of mercury wastes.

3.2.4 Legislative and Policy Recommendations

The major recommendations for Saint Lucia to fill the above identified legislative gaps and to promote environmentally sound mechanisms for mercury management are shown in Table 51. These are short- to medium-term recommendations and are expected to take 6-18 months to be implemented.

Table 51: Legislative recommendations for Saint Lucia

Legislation/ Regulations	Recommendation
External Trade Act (***6 to 12 months***)	Prohibit the further use of mercury-added products.
	Ban the importation of mercury and mercury products mercury using sections 3 and 4 of the External Trade Act (Chapter 13:11) and the Customs (Control and Management) Act (Chapter 15.05).
Chemical Management Policy ***(12 to 18 months)***	Develop and finalize a Chemical Management Policy to address what organization should take the lead in dealing with mercury and by extension other hazardous wastes and chemicals. Standardization can also be considered, either through use of standards for use or specification standards for chemicals or standards can also be referenced in relevant legislation.
New Legislation/Regulations ***(12-18 months)***	Enact legislation/promulgate regulations dealing with air pollution that would have provisions for the management of mercury emissions from processes such as waste incineration (Responsibility of Environmental Health).
	Enact hazardous waste regulations that would address releases of mercury and mercury compounds to water and land.
	Enact legislation/promulgate regulations to implement the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
	Enact legislation/promulgate regulations to implement the Minamata Convention

3.3 Assessment of Institutional Framework

3.3.1 Key Institutions

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

Sustainable Development and Environmental Division

The Sustainable Development and Environmental Division is the lead coordinating agency for environmental management in Saint Lucia. It has a wide mandate covering environment, climate change, ozone protection, waste management/pollution prevention/coastal zone management.

The Sustainable Development Division is the Focal Point for the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal and is responsible for receiving and transmitting information to the Secretariat of the Basel Convention. This division would take the lead on policy issues and coordinate the implementation measures for the Minamata Convention on Mercury.

The Sustainable Development and Environment Division would be responsible for Secretariat responsibilities for the proposed Steering Committee. The Division is currently strengthening the information sharing and coordination between different agencies with respect to the implementation of Multilateral Environmental Agreements. This process is being facilitated through a United Nations Environment Project. This improved coordination will be useful for the effective implementation of the Minamata Convention which requires a multi-sectoral approach.

The Saint Lucia Solid Waste Management Authority (SLSWMA)

The SLSWMA was established in 1996 and is charged with the responsibility of enhancing Saint Lucia's environmental integrity and the health of the people through the provision and management of an integrated system for public education and awareness and for the collection, treatment, recycling and disposal of waste.

The SLSWMA also has the responsibility for the establishment and management of the collection and treatment of hazardous waste. Further, the SLSWMA has the

responsibility under the Basel Convention for receiving notification of a transboundary movement of hazardous waste. The following measures to be addressed or adjusted are as follows:

- Establish/maintain as appropriate, procedures to ensure that mercury-containing wastes are shipped for environmentally sound disposal in accordance with Basel Convention requirements;
- Establish a phased national programme for the proper collection or disposal of fluorescent light for maximum and efficient use of the existing bulb crusher;
    a) Stage 1 of the programme to target hotels, warehouses, telephone companies, etc.
    b) Stage 2 of the programme to target households;
- Include mercury waste in the educational outreach component; and
- Hold consultations with medical and dental professionals regarding disposal of waste containing mercury.

Environmental Health Department

The Environmental Health Department operates under the provisions of the Public Health Act and the Litter Act. The Environmental Health Department has a wide mandate including regulatory oversight for the solid waste and sewerage sector. Over the years, due to manpower and financial constraints the Environmental Health Department has not been fully able to discharge its wide mandate. Environmental Health Department does exercise some supervisory oversight over the Solid Waste Management Authority. However; there is not much follow up as Environmental Health Department only visits the Solid Waste Management Authority once a year.

A new Public Health Act is being developed but the changes are not fundamental. It is agreed that air pollution and water quality monitoring would be the responsibility of Public Health, however; there is an issue of capacity as there are no labs, equipment or trained staff to carry out the tests.

Drug Inspector, Ministry of Health

All chemicals items coming into Saint Lucia are submitted to Drug Inspector for clearance. The Customs & Excise Department will not release the goods until the Drug Inspector indicates requirements for a licence or otherwise. The Drug Inspector is advised of all pharmaceutical and medical equipment and can determine alternatives to products. It is known that a number of products imported into Saint Lucia contain mercury and, to assist with identification, Drug Inspector has sent out a request for pharmacies to advise on items that contain mercury.

Pesticides and Toxic Chemicals Control Board

The Pesticides and Toxic Chemicals Control Board is responsible for the implementation of the pesticides and toxic chemicals regulations and procedures. The Board has prepared a list of prohibited pesticides and toxic chemicals and developed regulations for the establishment of specific premises to be used for storing, handling and distributing these substances. Regulations and procedures have also been developed for the importation licence for these substances as well as to control the labelling. The Board plays an integral role in the registration and licensing of all pesticides and toxic chemicals.

Labour Department

The Labour Department is responsible for the administration of the Labour Code, 2006. The Labour Department is responsible for a wide range of labour matters including dealing with contracts of employment, implementing the provisions of the Labour Code dealing with Health and Occupational Health and Safety.

Ministry of Trade

The Ministry of Trade is responsible for the administration and implementation of the External Trade Act. The Ministry is also responsible for the administration of Saint Lucia's trade policy.

Customs and Excise Department

The Customs and Excise Department has a wide range of responsibilities under various Acts including the Customs (Control and Management) Act (Chapter 15:05). Among the

duties of the Customs and Excise Department is the duty to monitor imports and to prevent illegal imports.

Saint Lucia Bureau of Standards (SLBS)

This Saint Lucia Bureau of Standards (SLBS) established pursuant to the Standards Act (Chapter 13:25). The SLBS has the power to promulgate compulsory standards in the interest of health and safety for consumers. For example, national standards could be developed to replace mercury thermometers and other instruments that use mercury with appropriate alternatives (alcohol thermometers). The SLBS is responsible for ensuring compliance of such standards.

The Saint Lucia Bureau of Standards, along with the Customs Division, can also monitor the mercury content of goods coming into the country. The SLBS has no capacity on its own to conduct tests for mercury but it has been noted that arrangements can be made with the Caribbean Public Health Agency (CARPHA) to undertake the tests.

3.3.2 Institutional Challenges and Priorities

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

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

Minamata Initial Assessment and progress on current work on the Minamata Convention on Mercury will considerably enhance data on mercury. Table 52 below summarizes, the cross-cutting issues related to mercury under each thematic area.

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

Table 52: Institutional cross-cutting issues related to mercury in Saint Lucia

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

Table 53 highlights a proposed framework for addressing institutional challenges related to the implementation of the Minamata Convention on Mercury.

Table 53: Proposed institutional framework for addressing institutional challenges for the implementation of the Minamata Convention on Mercury

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

Inter-Agency Committee

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

Saint Lucia has already established a special purpose vehicle in the form of a National Working Group to allow for inter-sectoral coordination and management of the activities under the MIA project. The Lead Agency (Department of Sustainable Development) has the responsibility for collaboration and partnership with relevant representatives' organizations comprising national government departments, agencies, and other stakeholder organizations comprising representatives from: academia, private sector organizations, research institutions, manufacturing associations, civil society groups, non-governmental and civil society organisations to achieve the project development objectives to enable implementation of the Convention.

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

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

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

Table 54 highlights the representative organizations that are members on the National Working Group at the various national levels, and describes the roles and responsibilities that each is expected to play in coordinating the effective implementation of the various components and sub-components of the Minamata Convention on Mercury.

Table 54: Proposed Steering Committee Representative Organisations in Saint Lucia

Proposed Steering Committee Representative Organizations	Summary of Overall Responsibilities and Potential Role under the Minamata Convention on Mercury
Ministry of Education, Innovation, Gender Relations and Sustainable Development (Department of Sustainable Development) (Chair)	▪ Focal Point for Minamata Convention on Mercury; ▪ Formulates policy; ▪ Provides oversight of implementation; ▪ Prepares drafting instructions; ▪ Collaborate with the SLSWMA to monitor generation and treatment of hazardous wastes; ▪ Assesses impact of mercury and other hazardous wastes on the environment (for example, fish kills); ▪ Acts as a referral agency for environmental impact assessments.
Environmental Health Department	▪ Monitors air quality and hazardous emissions; ▪ Monitors water pollution, management & quality;
Pesticides and Toxic Chemicals Control Board	▪ Regulates the use of hazardous chemicals, pesticides and other toxic chemicals.
Department of Commerce, International Trade, Investment, Enterprise Development and Consumer Affairs	▪ Enhances public education and awareness; ▪ Responsible for the grant of import licences where applicable.
Saint Lucia Solid Waste Management Authority	▪ Proper waste disposal of mercury & mercury-related products and other hazardous materials at landfills ▪ (for example thermometers, blood pressure machines, dental amalgams, fluorescent lamps, batteries, cosmetics); ▪ Disposal of containers; ▪ Recycles mercury, ferrous metals and others; ▪ Exports wastes, where required.
Saint Lucia Medical and Dental Association	▪ Assistance on issues related to dental mercury-amalgam fillings and other mercury-added medical devices;
Ministry of Finance (Customs & Excise Department).	▪ Determines whether mercury and mercury-based products are allowed to be imported; ▪ Monitors imports and prevents illegal imports.

Proposed Steering Committee Representative Organizations	Summary of Overall Responsibilities and Potential Role under the Minamata Convention on Mercury
Ministry of Health and Wellness	▪ Regulates environmental health; ▪ Regulates import and export of chemicals; ▪ Deals with food and drugs regulations; ▪ Regulates biocides and pesticides with mercury, Pharmaceuticals for human/veterinary use, Manometers and gauges, Laboratory chemicals and equipment; ▪ Provides guidance on procedures to be followed when handling chemicals and other hazardous materials. ▪ Public health education and awareness for mercury issues.
National Consumers Association	▪ Public awareness, education and sensitization programmes that promotes best practices for use, storage and disposal of mercury wastes and mercury-contaminated-based products.
Saint Lucia Chamber of Commerce	▪ Private sector – advocating private sector interests or concerns.
Labour Department	▪ Monitors and restrict the mercury used in manufacturing processes. ▪ Occupational health & safety of health care professionals
Development Control Authority	▪ Approves any applications for industrial developments
Attorney General's Chambers	▪ Formulates the legal and regulatory framework; ▪ Drafts appropriate legislation
Department of Fisheries	▪ Monitors fish and marine-related products for traces of mercury.
Saint Lucia Bureau of Standards	▪ Prepares, promotes and adopts standards related to mercury and mercury-based products; ▪ Promotes standardization, quality assurance and simplification in industry and commerce. ▪ To advance the improvement of the economy of Saint Lucia and the quality of life of its people by promoting quality, standardization and metrology. ▪ Promotes public and industrial welfare and health and safety ▪ safeguarding the environment ▪ Standards provide the technological and scientific bases underpinning health, safety and environmental legislation. ▪ Standards are consensus achieved in decision making when investing in scarce resources while avoiding technical barriers to trade. It defines the characteristics that products and services will be expected to meet not only on export markets but within the local markets.

3.4 Implementation of the Minamata Convention on Mercury

Accession to the Minamata Convention

In order to accede to the Minamata Convention, a memorandum to Cabinet would need to be prepared by the Sustainable Development and Environment Division to outline the proposal for accession. This proposal should include aspects such as the likely costs, the requirements for implementation and the benefits and drawbacks of accession. It should also outline whether it would be considered necessary for the Government to request any exemptions for phasing out certain MAPs based on assessments, as detailed in Article 6 of the Minamata Convention. It is advised that the Division collaborate with the Department of External Affairs in doing so.

If approved by Cabinet, the Department of Sustainable Development would be responsible for preparing the accession documents for signature and depositing it with the UN Treaties Section (New York), through the Department of External Affairs. After consultation with other agencies, the Sustainable Development and Environment Division would be required to coordinate the preparation of drafting instructions for dispatch to the Legislative Drafting Unit of the Attorney General Chambers.

A summary of the gap analysis with respect to the provisions of the Minamata Convention and coverage by existing legislation is presented in Table 55.

Table 55: Overview of the provisions of the Minamata Convention and coverage by existing legislation in Saint Lucia

Article and para. in MC	Impact of MC provision	Legislation addressing the provision/ obligation	Summary of Assessment	Covered by existing legislation
3 (3)	Restriction on new primary mercury mining	None	No ban in place/not applicable	No
3 (4)	Phase out of existing primary mercury mining	None	No ban in place/not applicable	No
3 (5) lit. (a)	Identification of mercury stocks	None	Not applicable	No
3 (5) lit. (b)	Disposal of excess mercury from decommissioned chlor-alkali facilities	None	Not applicable	No

Article and para. in MC	Impact of MC provision	Legislation addressing the provision/ obligation	Summary of Assessment	Covered by existing legislation
3 (6)	Restriction on mercury exports	None	No export ban for mercury/not applicable	No
3 (8)	Restriction on mercury imports	None	No import ban* *an import ban could be imposed under the External Trade Act	No
4 (1)	Prohibition of manufacture/import/export of certain mercury-added products (Annex A, Part I)	None	No manufacture or export of mercury-added products. Restriction on the import of mercury can be done under the External Trade Act. Legislation also needed to deal with the manufacture or export of mercury-added products	No
4 (3)	Measures with respect to dental amalgam (Annex A, Part II)	None	Article 4(3) speaks of "measures" so this can be accomplished by policy or administrative measures. Thus legislation would be unnecessary.	No
4 (5)	Preventing the incorporation of mercury-added products in assembled products	None	Compulsory Standard could be made under the Standards Act	No
4 (6)	Obligation to "discourage" the manufacture and distribution of new mercury-added products	None	Not applicable as no manufacture of mercury-added products. If after taking technical advice whether Saint Lucia will in the future be capable of manufacturing mercury-added products, then if deemed appropriate, legislation should be enacted to deal with this eventuality. It is assumed that in addition to technical advice, the issue would be also whether such manufacturing in the future would be consistent with any National Environmental Policy current at that time. In addition the Physical Planning Development Act and the Labour Act would be applicable to the manufacturing process.	No

Article and para. in MC	Impact of MC provision	Legislation addressing the provision/ obligation	Summary of Assessment	Covered by existing legislation
5 (2)	Prohibition of mercury use in the processes listed in Part I of Annex B	None	Not applicable as none of the processes listed in Part 1 of Annex B is done in Saint Lucia	No
5 (3)	Obligation to restrict the use of mercury in the processes listed in Part II of Annex B	None	Not applicable. No manufacture of mercury-added products. See additional comments to Article 4(6) above.	No
5 (5)	Obligation to take measures to "address" emissions and releases from all processes/to endeavour to identify facilities	None	Not applicable	No
5 (6)	Prohibition of using mercury in new facilities for the processes listed in Annex B	None	Not applicable	No
5 (7)	Discourage "the development of new facilities using any other mercury-based manufacturing process"	None	Not applicable	No
7 (2)	Reduce/eliminate emissions from Artisanal and small-scale gold mining (ASGM)	None	Not applicable	No
7 (3)	Determination of significance of ASGM/Developing and implementing a national action plan if applicable	None	Not applicable	No
8 (3)	Controlling emissions: Develop a national plan (optional)	None	Only applicable source may be waste incineration facilities	No
8 (3)/8 (4)	Required BAT/BEP for new sources	None	This relates to new sources as defined by Article 8(2)(c). It would be a matter of policy for Saint Lucia to determine whether it would allow any "new source". This issue does not arise at this time.	No
8 (3)/8 (5)	Emission control measures for existing sources	None	None	No
8 (7)	Establish emissions inventory	None	None	No

Article and para. in MC	Impact of MC provision	Legislation addressing the provision/ obligation	Summary of Assessment	Covered by existing legislation
9 (3)	Identify relevant sources for releases (to water and land)	None	None	No
9 (4)	Releases control	None	None	No
9 (6)	Establish release inventory	None	None	No
10 (2)	Storage of non-waste mercury	None	Not applicable	No
11 (3)	Mercury waste	None	None	No
12 (1)	Contaminated sites	The Physical Planning and Development Act	Schedule 4 of the Act requires that an Environmental Impact Assessment be submitted to the DCA in respect of, "Any industrial plant which in the opinion of the Head of the Physical Planning and Development Division is likely to cause significant adverse environmental impact." The strategies to assess potentially mercury contaminated sites could be considered when conducting such Environmental Impact Assessments.	No
16 (1)	Health aspects	Diverse legal acts in the following policy field: Public Health Act water drinking water food safety occupational health and safety	These acts address protecting general public vulnerable groups and workers	No

Chapter 4: Identification of Populations at Risk and Gender Dimensions

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

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

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

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

Certain groups are exposed to higher levels of mercury, either through a regular diet of fish and aquatic organisms, particularly larger predatory marine animals, occupational or environmental exposure, or through the consistent use of MAPs. Article 16 of the Minamata Convention encourages Parties to develop strategies and programmes to identify these populations at risk, including sensitive groups; to adopt science-based health guidelines and targets to reduce the negative health impacts of mercury exposure; and to increase the capacity of health-care systems to be able to better monitor, prevent and treat affected populations. Even though Saint Lucia is not a Party

to the Convention, effort can still be made to achieve this aim to ensure that the mercury impact is minimized among its population.

4.1.1 Mercury exposure to humans through seafood[21]

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

There are many studies on the impact of methylmercury toxicity to the neurological, cardiovascular, and immune systems within humans. For example, neurological impacts are often measured and become evident through lowered IQ levels (Spadaro and Rabl, 2008) and through various neuropsychological tests (Grandjean et al., 1998). Cardiovascular and immunological impacts are often related to chronic exposure to mercury (Sweet and Zelikoff, 2001; Downer et al., 2017). The relative impacts from methylmercury's toxic effects can vary across human populations as some groups are more sensitive to the impacts of exposure. Methylmercury is known to affect neurological development in children and is also linked to cardiovascular disease in adults (Clarkson et al., 2003; Valera et al., 2011; Grandjean et al., 2012).

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

Table 56 shows guidelines for the safe consumption of seafood containing mercury that were created based on the U.S. EPA reference dose of $1x10^4$ mg of Hg/kg of body weight/day, a body weight of 132 pounds (60 kg) for an adult female person, and a fish

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

meal size of about 6 ounces (170 grams). These guidelines are for muscle tissues in fish as >95% of Hg is in the methyl form, and therefore this consumption guidance cannot be directly used with the shellfish total mercury data.

Table 56: US EPA guidance for seafood consumption based on mercury concentrations

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

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

Some regularly and commercially harvested seafood from Saint Lucia can be safely consumed either on a daily or weekly basis, as they may have average mercury concentrations under 0.22 ppm, ww. Blackfin Tuna, various species of Snapper, Queen Conch, and other small individuals may be among these species. On the other hand, mercury concentrations may be higher in large pelagic, predatory and long-lived species like the Great Barracuda. Mean mercury levels in these larger species may exceed 0.22 ppm, and it is recommended that human consumption be limited to only one meal per month as they are riskier choices. Fish and seafood with Hg concentrations over 0.95 ppm, ww should not be consumed regularly in Saint Lucia.

The monitoring of mercury in fish and seafood in Saint Lucia, such as the mid-tropic level Bonefish, the Crevalle Jack, and the White Grunt, needs to be improved to ensure accurate exposure estimates over time, and to inform advisories on healthy dietary practices throughout the country.

As part of the MIA project, a rapid assessment of total mercury (THg) concentrations in fish was conducted in Saint Lucia which involved the collection of tissue samples from

several commonly consumed fish to evaluate the potential risk of exposure through human consumption and; the assessment of the location of capture for the fish sampled in order to assess and identify sites or habitats that may contain elevated concentrations of mercury that could represent a risk to fish and wildlife. This assessment would also be able to inform the identification of potentially contaminated sites (Buck, 2017).

A total of fifty-two (52) tissue samples were collected from nineteen (19) different species of marine organisms ranging from lower trophic level organisms such as the Queen conch (*Strombas gigas*) to upper trophic level species including Great barracuda (*Sphyraena barracuda*) and Black jack (*Caranx lugubris*). Species with the lowest mean tissue mercury concentrations included the Atlantic creole fish (*Paranthias furcifer*) (THg = 0.014 ppm, ww; N=1) and the Queen conch (mean THg = 0.015 ± 0.006 ppm, ww; N=6).

Of the 52 individual fish samples collected, eight (8) had concentrations that were above the Great Lakes Commission and/or WHO consumption guidelines. These included three (3) of the six (6) Great barracuda with concentrations of 0.260, 0.308, and 0.564 ppm, ww. Other individual fish with THg concentrations above these consumption guidelines included Tomtate (*Haemulon aurolineatum*), Crevalle jack (*Caranx hippos*), White grunt (*Haemulon plumierii*), Black jack (*Caranx lugubris*) and Bonefish (*Albula vulpes*). The most elevated THg concentration was observed in the largest individual Great barracuda that was sampled (THg = 0.564 ppm, ww; total length = 105 centimeters).

The number of species sampled and the relatively small sample sizes per taxon limited any robust statistical assessment of the data. It was also difficult to compare locations because in general different species of fish were collected from each location.

Results from this rapid assessment of fish mercury concentrations provide important information on the potential for mercury exposure through the consumption of marine fishes from the waters adjacent to Saint Lucia. Overall, fish THg concentrations are relatively low.

The data provides important preliminary data on certain taxa of economic importance on the island and identifies species (e.g. Great barracuda) where fish Hg concentrations may represent a risk of exposure through consumption for humans. Although not commonly consumed, the elevated THg concentration in bonefish presents a unique question regarding the pathways for Hg exposure in the near-shore environments around Saint Lucia, particularly in a fish species that is not considered a top-level predatory fish. Therefore, further study is required to investigate the source(s) of elevated Hg in this region, to expand sampling of other fish species, and expand sampling to additional areas adjacent to Saint Lucia in order to confirm if this sampling area is uniquely elevated in mercury and if certain species can serve as bio-indicators in future studies of mercury contamination in the region and elsewhere within their range (Buck, 2017).

4.1.2 Occupational and environmental exposure to mercury

Populations involved in professions that expose them to elemental mercury or mercury compounds are at a higher risk due to the increased frequency of exposure. The potential risks to the relevant occupations in Saint Lucia are described below in Table 57.

People living in areas that are more susceptible to environmental contamination by mercury are also more likely to be affected by mercury exposure. These higher risk areas are typically around hot spots and point sources of uncontrolled mercury release such as the Deglos Sanitary Landfill, the Vieux Fort Landfill, closed and existing informal waste disposal sites, the Cul De Sac Power Plant, wastewater treatment facilities, cemeteries and crematoria. Further, if the geothermal energy potential of the Sulphur Springs is explored and utilised in the future, residents of nearby communities may also become at risk of mercury exposure from the resulting activities if mercury is naturally present in the geology and located in a sensitive area. Point sources of mercury release should ensure controls are in place to prevent/reduce emissions to the environment, and decrease the risk to nearby residents.

Table 57: Occupational exposure to mercury in Saint Lucia

Occupation	Cause of potential mercury exposure
Waste collectors, medical waste incinerator workers and landfill workers	Handling and disposal of end-of-life mercury containing products from households and hospitals, including thermometers, fluorescent light bulbs, batteries, materials containing polyurethane, and electrical switches and relays. Informal burning of waste mercury-containing products
Dental professionals including dental assistants	Preparation, use and disposal of dental amalgam fillings. Use of mercury-containing medical equipment.
Medical professionals	Handling of mercury-containing medical equipment such as thermometers, medical blood pressure gauges, barometers, pressure gauges, and other manometers and gauges. Clean-up of damaged or broken equipment.
Environmental/enforcement officers	Identification, monitoring and evaluation of potentially contaminated sites and mercury-containing products.
Firemen and first responders to chemical accidents	Clean-up of mercury-containing chemicals and products.
Laboratory workers	Use and clean-up of mercury-containing chemicals.
Other industrial workers	Inhalation of mercury-contaminated particles from oil combustion facilities, and crematoria. Handling of mercury-containing residues.

To reduce the risk of mercury exposure in these fields, training on the associated risks should be made mandatory for workers, and personal protective equipment should be required on all industrial sites. Generally, best environmental practices and best available techniques should be identified and employed to manage mercury residues, clean-up broken medical and measuring devices containing mercury, and dispose of mercury and its compounds.

4.2 Assessment of potential gender dimensions related to the management of mercury

The Basel, Stockholm, Rotterdam and Minamata Conventions have highlighted the importance of ensuring gender mainstreaming in countries in order to implement these Conventions. The United Nations Economic and Social Council has defined 'gender mainstreaming' as, "a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of the policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated" (UNDP, 2007).

Gender mainstreaming is also a critical component for countries to achieve gender equality; that is, a society where "the interests, needs and priorities of both women and men are taken into consideration" and where "the diversity of different groups of women and men" is recognized. Gender equality is listed as one of the United Nations Sustainable Development Goals. It should be noted that there are currently no gender mainstreaming considerations being implemented in the DSD. It is recommended that this be incorporated into the Department in the future, not only in their potential implementation of the Minamata Convention, but also in their activities related to achieving the United Nations Sustainable Development Goals.

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

An extensive survey and assessment of gender issues related to mercury exposure in Saint Lucia is not yet defined, however; a descriptive summary was developed to broadly apply across the country's populations relating to general exposure and gender risks within various sectors where mercury contamination is likely to occur. Exposure to mercury in Saint Lucia was determined to occur through fish consumption, household use and disposal of MAPs, and occupational exposure to mercury and its compounds.

The use of skin lightening creams and other cosmetics containing mercury in Saint Lucia is not confirmed. However, it is assumed that if members of the population are indeed engaged in the use of these products, exposure would primarily be to women as global studies have indicated that women are more likely to use these products than men (Pierre-Louis, 2017).

Research by Copan et al (2015), indicated that use of mercury-added skin lightening creams by mothers provided a route of mercury exposure to their young children. For example, one case assessed by Copan et al (2015) indicated that a 20-month old child diagnosed with mercury poisoning presented symptoms such as refusal to walk, difficulty sleeping, irritability and poor appetite. Mercury contamination was determined to be caused by the use of skin lightening products with high mercury concentrations by the child's mother.

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

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

4.2.1 Occupational Exposure

Certain occupations that may expose workers to mercury throughout the various sectors may be more oriented towards women or men. As a result, gender differentiation among workers in various occupational roles needs to be taken into consideration when developing a strategy to determine and mitigate the effects of occupational exposure to mercury.

According to data from the Central Statistics Office in Saint Lucia, in 2016, female participation in the Saint Lucian labour force was 67.4%, while male participation was 78.2%. Figure 8 shows the gender differentiation in the various sectors that could pose a risk to occupational exposure of mercury during 2016.

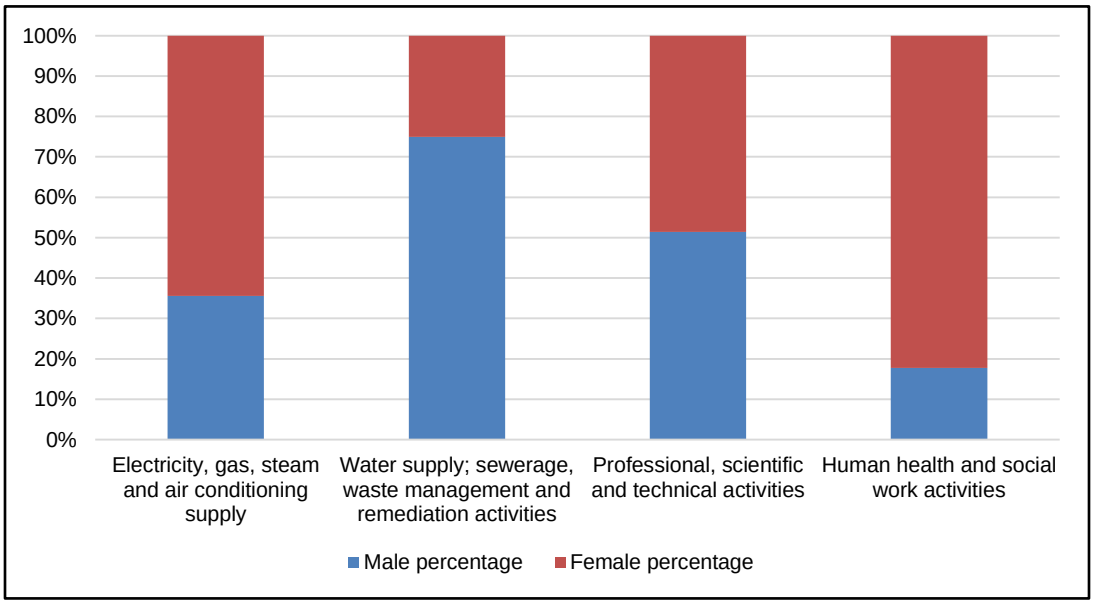

Figure 8: Distribution of sectors potentially exposing workers to mercury in 2016 by gender (Data Source: CSO, 2016)

Although the electricity, gas, steam and air conditioning supply sector in Saint Lucia employs more women, consideration must be made for the technical occupations that could potentially put workers into contact with mercury-contaminated residues, in which approximately 80.4% of those positions were held by men. Similarly, roles that may cause occupational exposure to mercury and its compounds in the water supply, sewerage and waste management sector were primarily filled by men.

Healthcare workers include dentists, doctors, nurses, technical assistants, facility maintenance staff, administrative staff and other medical staff who may come into contact with mercury and its compounds through the use and disposal of mercury-added devices. In Saint Lucia, mercury exposure through this sector may primarily affect women who are susceptible to the effects of mercury exposure, especially those of child-bearing age.

Both genders may be equally at risk to mercury exposure through laboratory exercises that require the use of mercury and its compounds, or through the use and disposal of mercury-containing devices.

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

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

The level of awareness on the risks of mercury among identified stakeholders and target populations in Saint Lucia can vary based on the information provided. Measures should be put in place to educate these groups on the hazards of mercury exposure and the possible action to mitigate the risks. Article 18 in the Minamata Convention on Mercury states that:

1. Each Party shall, within its capabilities, promote and facilitate:
    a) Provision to the public of available information on:
        i. The health and environmental effects of mercury and mercury compounds;
        ii. Alternatives to mercury and mercury compounds;
        iii. The topics identified in paragraph 1 of Article 17;
        iv. The results of its research, development and monitoring activities under Article 19; and
        v. Activities to meet its obligations under this Convention;
    b) Education, training and public awareness related to the effects of exposure to mercury and mercury compounds on human health and the environment in collaboration with relevant intergovernmental and non-governmental organizations and vulnerable populations, as appropriate.
2. Each Party shall use existing mechanisms or give consideration to the development of mechanisms, such as pollutant release and transfer registers where applicable, for the collection and dissemination of information on estimates of its annual quantities of mercury and mercury compounds that are emitted, released or disposed of through human activities.

Residents in close proximity to mercury point sources, such as industries that burn fossil fuels and facilities that handle waste disposal and incineration, should be informed of

the added risk of mercury exposure. These targeted groups should be directed on proper safety measures to reduce risks. Similarly, workers at these facilities can be educated on the proper use of personal protective equipment to reduce exposure, and measures to reduce the release of mercury to the environment.

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

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

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

The Government should ensure that the public has access to environmentally sound facilities that could aid in the disposal process. The public should also be informed on where they would be able to access additional information and guidelines for cleaning up disturbed MAPs, such as broken fluorescent tubes. The US EPA guidelines on cleaning up broken CFL bulbs demonstrates how an online interface can be used to

provide effective, concise information (US EPA, 2016). This can be used as a resource when creating similar tools for spreading information.

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

Chapter 6: Implementation Plan and Priorities for Action

Article 20 of the Text of the Minamata Convention on Mercury states that, “each Party may, following an initial assessment, develop and execute an implementation plan, taking into account its domestic circumstances, for meeting the obligations under this Convention.”

The development of an implementation plan is the responsibility of the Government and is optional.

In Saint Lucia, the general consumption of mercury in other intentional products/process uses and the consumption of general mercury added products were the main sources of mercury releases that would need to be addressed in order to ensure that Saint Lucia is in compliance with the obligations of the Minamata Convention. Waste deposition is also an area that needs to be effectively managed.

This chapter highlights some practical considerations that may be taken should the Government of Saint Lucia choose to develop an implementation plan and a list of priorities for action regarding the management of mercury and its compounds.

6.1 Recommendations for Management of Mercury-Added Products (Whole Life Cycle)

The manufacture and use of MAPs needs to be addressed to ensure that the Government of Saint Lucia is in compliance with the obligations of the Minamata Convention as set out in Article 4.

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

The obligations for the disposal of such MAPs are also outlined in Article 11. While some of the mercury in these products can be collected and recycled, Saint Lucia faces

issues which reduce the feasibility of such measures. These issues include a lack of enforced requirements for manufacturers to list all of the components of their products, which leaves users and disposers unaware of the need for special disposal; inefficient collection and disposal systems; a lack of access to storage and recycling facilities; and little public awareness on the hazards of MAPs and their proper disposal.

Additionally, while there is a general push to promote the use of mercury-free and mercury-reduced alternatives, public awareness on the hazards of mercury and the benefits of using mercury-free alternatives should be enhanced to encourage a higher substitution rate. There is also an unfounded perception that mercury-free alternatives do not perform as accurately as their mercury-containing counterparts.

Specific recommendations for managing the manufacture, import and export of these products under legislation and regulatory framework were detailed in Chapter 3 of this report. Other recommendations for the phase out of MAPs in Saint Lucia are listed in Table 58.

Table 58: Recommended action for phasing out MAPs (adapted from Lennett and Gutierrez, 2016)

MAP	Recommended Action for Phase-Out
Switches and Relays	● Promote the use of Hg-free alternatives which are already widespread on the market. For example, electronic mercury-free alternatives are proven effective and widely available and many manufacturers now produce mercury-free switches and relays because of restrictions in the EU's RoHS Directive. Mercury-free alternatives include hybrid tilt switches and electronic thermostats[1] ● Take measures to prevent use as components in larger products like pumps, appliances, ovens and circuit boards ● Ensure that allowable high accuracy capacitance and loss measurement bridges and high frequency radio frequency switches and relays in monitoring and control instruments maintain a maximum mercury content of 20 mg per bridge, switch, or relay ● Set up waste electrical and electronic equipment (WEEE) dismantling plants to remove switches and relays from non-hazardous waste streams
Batteries	● Promote the use of Hg-free alternatives, such as cylinder (alkaline rechargeable) batteries which are already common on the market[1] ● Prevent the import and use of mercury containing batteries in devices used for medical, industrial or military applications and electronics ● Ensure that allowable mercury-containing button zinc silver oxide and button zinc air batteries used maintain acceptable limit of <2% Hg content. This limit is typically in accordance with the batteries on the global market currently

	• Put measures in place, eg. WEEE dismantling plants, to remove batteries from non-hazardous waste streams
Lighting Devices (CFLs, LFLs, HPMV, CCFLs, EEFLs)[2]	• Promote the use of LEDs and other Hg-free lamp alternatives for general purpose lighting and LCD backlighting[1]. The amount of Hg needed per lamp has decreased over the years due to technology/production improvements, including better dosing. Therefore, meeting this requirement globally is becoming easier. The People's Republic of China which manufactures many of these products for worldwide export is Party to the Minamata Convention and has implemented plans to meet the obligations for manufacture in accordance with the Convention's obligations (Kamande, 2017) • Set and enforce low maximum mercury content limits for lamps imported and used • Restrict the use of HPMV and enforce the use of available alternatives • Purchase bulb-eaters to facilitate recycling or environmentally sound disposal of end-of-life fluorescent tubes • Set up WEEE dismantling facilities to separate CCFLs and EEFLs from non-hazardous waste streams
Non-Electronic Measuring Devices (Barometers, Hygrometers, Sphygmomanometers, Thermometers etc.)	• Promote the use of cost-effective Hg-free alternatives. Digital and aneroid Hg-free alternatives to these products are already popular on the global market. • Utilise guidance documents on phasing out these products which have been developed by the World Health Organization and Health Care Without Harm who began a global campaign to shift the production of mercury-added medical devices to Hg-free alternatives by 2017[1] • Enforce on-site separation of these devices from non-hazardous waste streams and waste incineration streams
Cosmetics (Skin Lightening Products)	• Establish measures to regulate the import and local manufacture of skin lightening products[3] • Compile a local inventory of mercury containing cosmetics to better inform governments and public[3] • Develop and enforce proper labelling standards • Promote the use of cost-effective Hg-free alternatives • Ban the manufacture, import and export of mercury-added cosmetics • Conduct public awareness campaigns
Dental Amalgam	• Encourage the use of cost-effective and clinically effective mercury-free dental restoration options to phase-out the use of Hg-added dental amalgam • Provide training and education opportunities for professional dentists and students in dental school on mercury-free dental restoration options and best practices[4] to prevent release of mercury into the environment

1 Some of the recognized existing guidance documents are available at the following links (Kamande, 2017):

- *Report on the major mercury-containing products and processes, their substitutes and experience in switching to mercury-free products and processes, UN Environment OEWG2: http://www.mercuryconvention.org/Portals/11/documents/meetings/oewg2/English/2_7.pdf.*

- *Mercury-added Product Fact Sheets, Northeast Waste Management Officials Association: http://www.newmoa.org/prevention/mercury/imerc/FactSheets/.*
- *Developing National Strategies to Phase Mercury Out of Thermometers and Sphygmomanometers Including in the Context of the Minamata Convention on Mercury, WHO: http://www.who.int/ipcs/assessment/public_health/WHOGuidanceReportonMercury2015.pdf.*

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

3 Skin-lightening products are one of the most unregulated MAP sectors in the Caribbean. Due to the rising popularity of skin bleaching within communities and the prevalence of informal local and international manufacturers and retailers, it is critical that countries put measures in place to identify and restrict products on the market that contain mercury. As many of these products tend to be mis-labelled/ improperly labelled, the mercury concentration in such products can only be accurately determined through laboratory analysis and research. Projects are currently being conducted globally by organizations under the Global Mercury Partnership to assess mercury concentrations in popular skin lightening creams and make the results publicly available. Locally, research is being conducted by the University of the West Indies with funding from the Pan American Health Organisation to analyze mercury concentration in skin-lightening creams and conduct public awareness campaigns based on the results.

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

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

Import Regulations

Under Article 4 of the Minamata Convention, Parties will not be permitted to manufacture, import or export certain MAPs after the year 2020. To facilitate this transformation, the Government of Saint Lucia should strengthen the standards with regards to MAPs by beginning to phase-out these products, setting and enforcing maximum allowable mercury content for products that have no available mercury-free

alternatives, and ensuring transparent product labelling and training of customs officers to inspect and regulate the import of these products.

The responsible entity in Saint Lucia for the inspection and approval of goods that may contain mercury is Saint Lucia Bureau of Standards (SLBS) under the Ministry of Commerce, Industry, Enterprise Development and Consumer Affairs.

Product Labelling

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

Developing and enacting legislation that enforces transparent labelling of products by their producers are therefore critical steps to aid in the proper collection and disposal of such goods, and to raise public awareness that would lead to the subsequent phase-out of manufactured and imported MAPs. Figure 9 is an example of a label that discloses the presence of mercury in fluorescent bulbs and directs users to further information on clean-up procedures and safe disposal.

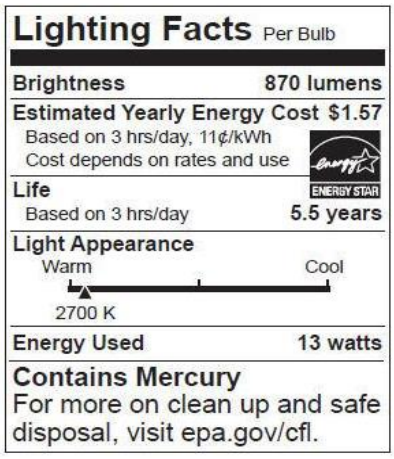

Figure 9: Sample of label for bulbs containing mercury (Source: US EPA, date unknown)

Inspection and Testing

Local Government Divisions that oversee the inspection and approval of imported and locally manufactured goods will need to acquire equipment for the inspection and testing of MAPs entering the country as well as being used by the citizenry. These divisions may consider purchasing a Direct Mercury Analyzer (DMA) to test potentially mercury-containing products that are available, or will be made available, to the public. The *Milestone DMA-80* is an example of equipment that could be used to test up to 40 liquid or solid samples at a time (Figure 10). Samples do not need to be prepared with additional chemicals as with older mercury analyzers, and mercury concentrations between 0.01-300 ppm can be detected in as little as 120 seconds (Milestone, 2013). The cost of this equipment averages at US $35,000 based on the application and configuration required to achieve the aims of the establishment.

Identified MAPs should be placed on a restricted list, and Customs workers should be trained to recognize them to aid in preventing them from entering the country.

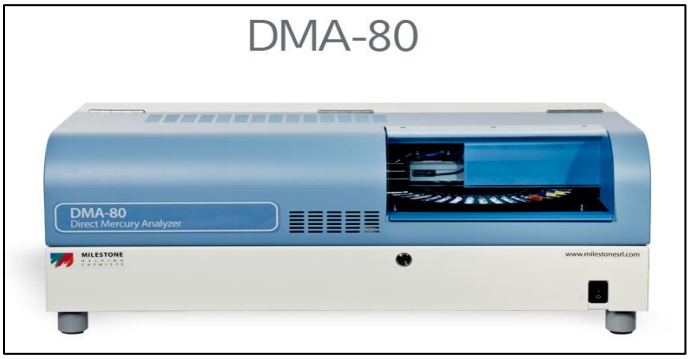

Figure 10: Milestone DMA-80 direct mercury analyzer (Source: Milestone, 2013)

Furthermore, Customs Officers should be trained and equipped with a portable mercury analyzer, such as the *Lumex RA-915M Mercury Analyzer*, which would enable them to identify unlisted mercury-added items being collected at the ports, and more importantly, incoming MAPs that are not clearly labeled to show that they contain mercury (Figure 11). The RA-915M can detect mercury in air samples with concentrations as low as 0.5 ng/m^3 or 0.0005 ppm, and will give a real-time rapid analysis of mercury contained in complex objects (Lumex Instruments, 2017). The

sensitivity of the RA-915M will aid in the identification of smaller, unidentified mercury-containing components, such as batteries and switches in electronic equipment. The *Lumex RA-915M Mercury Analyzer* costs approximately US $30,000.

Figure 11: Lumex RA-915M portable mercury analyzer
(Source: Lumex Instruments, 2017)

Extended Producer Responsibility

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

6.2 Recommendations for Management of Mercury Wastes

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

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

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

Stabilization, Solidification and Interim Storage of Mercury Wastes

It is important to create guidelines that ensure that the compatibility of these waste chemicals is taken into account first and that radioactive, infectious or explosive wastes are excluded. Further detailed guidelines for construction, placement and important inclusions for interim storage sites for mercury and hazardous chemicals can be found in the Draft Interim Storage Guidelines outlined at the first Conference of the Parties to the Minamata Convention (UNEP, 2017b) and the UNEP 'Practical Sourcebook of Mercury Storage and Disposal' (2013b). It should be noted that based on the relatively small amount of mercury releases estimated in the inventory for Saint Lucia, the following may not be applicable or feasible. A harmonised approach to waste management for mercury wastes as well as other hazardous waste streams may be more relevant.

Collection methods and transportation procedures are crucial in the success of an environmentally sound hazardous waste storage facility. Saint Lucia's Government may dedicate collection centers throughout the nation with easy access to the public or

organize mail-in or pick-up services. Vehicles transporting mercury waste need to adhere to specific requirements, such as creating routing plans to ensure the shortest and fastest routes are used if necessary, ensuring the presence of a bulkhead between the driver and the vehicle body, and confirming appropriate safety and emergency equipment are on board. It is essential for mercury waste to be packaged in compatible and sealed containers and not stacked more than 1.5 meters high (Emmanuel, 2010).

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

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

Hydramag, an industrial stabilizing agent based on magnesium oxide, was shown to significantly decrease the volumes of leachable mercury from mercury-contaminated soil in Mongolia (Figure 12). The results of this study showed that using stabilization methods to treat similar wastes before disposal in specially engineered landfills can greatly reduce the leaching potential of mercury and prevent pollution of surface water and groundwater (UNIDO, 2017). Treated material should be temporarily stored until a

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

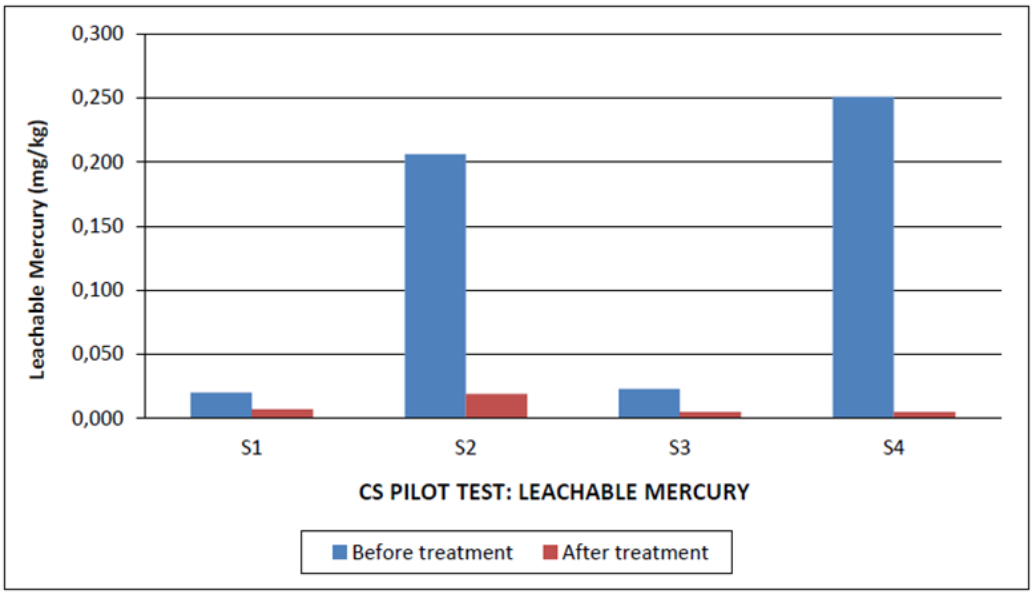

Figure 12: Mongolia chemical stabilization pilot test on mercury-contaminated soils (Source: UNIDO, 2017)

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

To facilitate the safe recycling or disposal of fluorescent tubes, a bulb recycler system or a bulb crusher is encouraged. While it was noted that a bulb crusher is currently stored at the Deglos Sanitary Landfill, it is currently not in use and is also only capable of processing LFLs. It is recommended that a bulb crusher system be able to handle various sizes and shapes of fluorescent bulbs and should utilize vapor filters to minimize dust and mercury vapor emissions. A bulb recycler system separates mercury bearing phosphor powder from the other components of fluorescent bulbs (glass and aluminium/plastic) and cleans the separated materials which can then be recycled or

disposed. CMA Ecocycle in Australia is an example of a facility that successfully manages this approach (CMA Ecocycle, 2015).

A drum-top bulb-crusher or other bulb-crusher mechanically crushes the fluorescent tubes and collects the waste-material in an airtight drum. The bulb crusher does not separate the glass, end caps or mercury bearing phosphor powder, and all collected material, including used filters, will have to be sent to another facility for separation and recycling, or encapsulated in a mercury-immobilizing material before being disposed of in a managed engineered landfill. Crushing the bulbs before shipping for treatment or disposal reduces the volumes needed to be transported, and therefore reduces the associated costs. The Dextrite bulb crusher shown below (Figure 13) costs approximately US $15,000, inclusive of transportation costs.

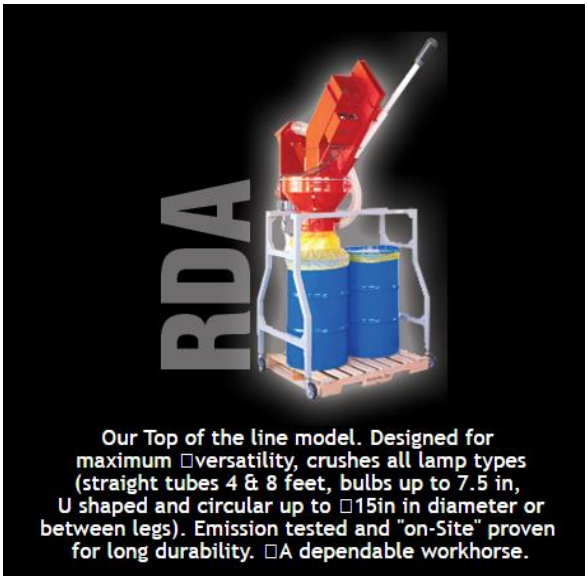

Figure 13: Features of the Dextrite bulb crusher (Source: Dextrite, 2017)

The Basel Convention 'Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with mercury or mercury compounds' (UNEP/CHW.12/INF/8, 2015) is a useful resource for environmentally sound handling (F1), separation (F2), collection (F3), packaging and labelling (F4), transportation (F5), storage (F6) and disposal (G) of mercury contaminated wastes. The

listed measures should be followed when constructing and operating the recommended facility.

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

Waste Disposal

Proper waste management methods are essential for the protection of Saint Lucia's health and environment. As detailed in Section 2.7, waste disposal in Saint Lucia is done in a controlled manner with the development of the designated sanitary landfills. At both sites there are measures for separation of municipal, medical and hazardous waste and the use of protective lining under the deposits.

It has been noted that spontaneous combustion of waste and underground burn also occurs occasionally and measures should be put in place to manage this. The development of a SEL is guided by the guidelines under the Basel Convention.

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

Many household consumer products and medical waste products that contain mercury or mercury compounds, such as fluorescent light bulbs, batteries and thermometers end up at landfills mixed in with municipal waste. The predominant recommendation to

reduce this mercury content in the landfills will coincide greatly with the recommendations for the nation to switch to the use of mercury-free alternative products. However; as MAPs are still currently circulating throughout society, these mercury control waste management procedures need to applied in unison.

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

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

6.3 Recommendations for Management of Mercury Emissions and Releases

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

Lucia, there were no relevant point sources identified as possibly contributing to mercury emissions.

Under Article 9 of the Minamata Convention, Parties shall take measures to control releases to water and land from major point sources and may prepare a national plan to assist in the monitoring of the effectiveness of implementation. Based on the mercury inventory conducted, mercury released from crematoria and cemeteries as well as the extraction and use of fuels/energy sources were found to contribute to minor releases of mercury.

Under these Articles, Parties must implement either one or more of the following measures to “control” releases:

- Develop mercury release limit values;
- Use BAT / BEP;
- Implement a multi-pollutant control strategy; and/or
- Develop alternative measures to reduce releases.

Although it is difficult to remediate existing cemeteries of their potential mercury contamination, there are procedures that may be considered for the future reduction of mercury releases in cemetery and cremation practices. It is recommended that future cemetery site developments should be considered with respect to environmentally sensitive areas. Cemeteries should not be located near waterbodies, vulnerable ecosystems and floodplains. It is also necessary to consider the future placement of crematories as they should not be located in areas that are downwind of densely populated or vulnerable areas. Provisions to ensure this is done are already in place under the Burial and Cremation Act of Saint Lucia (2016).

For crematoria, emission stacks can be monitored for mercury emissions and the funeral homes may consider the introduction of modern mercury filtration systems, carbon injection methods, scrubbers or dust filters into their crematoria chambers; however, this is an expense that may not be feasible. Cultural, social, structural, financial and heritage boundaries of individual funeral homes are to be considered when recommending changes to determine feasibility. Certain mechanisms can be put in place to ease the transition of updating to a more environmentally sound establishment,

such as implementing government assistance or a burden-sharing scheme to ensure that the full cost would not fall fully on the funeral homes themselves (Lymberidi and Lemoine, 2007).

Both alternative and “end-of-pipe” measures need to be taken into account and applied in parallel due to the already accumulated dental amalgam in the population. Removing the dental amalgam from a corpse before the burial or cremation will reduce the mercury emissions, but this can be regarded as unacceptable in certain cultures. A voluntary tooth-extraction system, similar to an organ donor system, can be set up for the person to consent to while still alive or for the next of kin to make this decision.

It should also be ensured that environmentally sound measures are in place to control the release of pollutants including mercury from the use of fuels, and in the development of geothermal energy production processes.

Under the Minamata Convention, Parties are also encouraged to regularly update their inventories of mercury emissions and releases.

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Annex 1: Stakeholder Engagement Process

National Project Workshops' Stakeholder List

Agency/Organisation	Representative	Designation	Contact Information [+758]
Department of Commerce, International Trade, Investment, Enterprise Development and Consumer Affairs	Mr. Kenneth Goolaman	Chief Import Monitoring Officer	Work Phone: 468-4246 Mobile Phone: 285-8253 Fax: 453-7347 Email: Kenneth.goolaman@govt.lc
Department of External Affairs	Ms. Maria Jean Baptiste	Foreign Service Officer	Work Phone: 468-4511 Email: mjnbaptiste@gosl.gov.lc
Department of Fisheries	Ms. Shanna Emmanuel	Fisheries Biologist	Work Phone: 468-4140 Fax: 452-3853 Email: shanna.emmanuel@govt.lc
Pharmacy Council	Ms. Astrid Mondesir	Drug Inspector	Work Phone: 458-2258 Mobile Phone: 285-6321 Email: druginspectorslu@gmail.com
Sustainable Development and Environment Division	Ms. Shanna Scott	Ozone Assistant	Work Phone: 468-5807 Mobile Phone: 721-9164 Email: shanna.scott@govt.lc
	Ms. Kasha Jn Baptiste	Sustainable Development and Environment Officer	Work Phone: 451-8746 Mobile Phone: 489-8117 Email: kayjnbaptiste@gmail.com
	Ms. Yasmin Jude	Sustainable Development and Environment Officer/National Project Coordinator	Work Phone: 451-8746 Mobile Phone:718-3826 Email: yasmin.jude@gmail.com
	Mrs. Annette Rattigan- Leo	Deputy Chief Sustainble and Environment Officer	Work Phone: 451-8746 Mobile Phone: 724 7468 Fax: 450-1904 Email: aleo@sde.gov.lc
	Ms. Kate Wilson	Legal Officer	Work Phone: 468-2281 Email: kate.wilson@govt.lc
	Mr. Lucius Doxerie	Communication Officer for the Disaster Vulnerability Adaptation Project (DVRP)	Work Phone: 451-8746 Email: doxeriel@gmail.com
	Ms. Caroline Eugene	GEF Focal Officer/ Chief Technical Officer	Work Phone: 451-8746 Email:

Saint Lucia Bureau of Standards	Mr. Edgar Stephen	Standards Officer	Work Phone: 453-0049
			Mobile Phone: 285-7654
			Fax: 452-3561
			Email: e.stephen@slbs.org
Saint Lucia Solid Waste Management Authority	Mr. Davis Poleon	Zone Supervisor	Work Phone: 454-9809
			Mobile Phone: 724-5528
			Fax: 454-6176
			Email: zssouth4@sluswma.org
Saint Lucia Manufacturing Association	Mr. Nicholas Barnard	Executive Manager	Mobile Phone: 720-9555
BCRC-Caribbean	Ms. Beana Joseph	NPC (Inventory) St. Lucia	Phone: 452-1095
			Mobile Phone: 727-6439
			Email: beanajoseph@outlook.com
	Ms. Jewel Batchasingh	Senior Technical Officer/Regional Project Coordinator	Work Phone: 1-868-628-8369; 1-868-9372; 1-868-628-9782
			Fax: 1-868-628-2151
			E-mail: jewel.batchasingh@bcrccaribbean.org
	Dr. Winston McCalla	Legal Expert	Work Phone: 1-876-926-7681
			Mobile Phone: 1-876- 999-9639
			Email: vin5002001@yahoo.com winstonconsult@yahoo.com
	Ms. Tahlia Ali Shah	Project Execution Officer	Work Phone:1-868-628-8369; 1-868-9372; 1-868-628-9782
			Fax: 1-868-628-2151
			Email: tahlia.alishah@bcrccaribbean.org
Biodiversity Research Institute	Dr. David Evers	MIA Report Technical Consultant	Email: david.evers@briloon.org

Stakeholder Questionnaire Templates

A. Questionnaire for Power Station

B. Questionnaire for Fuels

C. Questionnaire for Customs Division

D. Questionnaire for Dental Sector

E. Questionnaire for Waste Incineration

F. Questionnaire for Waste Deposition

G. Questionnaire for Waste Water Treatment

H. Questionnaire for Funeral Homes

A. Questionnaire for Power Station
Minamata Initial Assessment Project

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

Please provide current and accurate information in the spaces provided below.

Power from refined oil

Concentration of mercury (mg mercury/tonne)	Oil used (tonnes/year) (2014)	Mercury release to air, land, water, etc is dependent on the type of emissions controls present. Output Scenario
	-Heavy Fuel Oil -Diesel	1. Oil Combustion Facility with no emissions controls ☐ 2. Oil Combustion Facility with PM control using an ESP or scrubber ☐ 3. Power plants with cESP and FGD ☐
		Other:

Abbreviations: PM – Particulate Matter (dust), ESP – Electrostatic Precipitators, cESP – (coldside) Electrostatic Precipitators, FGD – Flue Gas Desulfurization

Power from natural gas

Is natural gas refined? Yes ☐ No ☐

Natural gas used raw ☐ or pre-cleaned ☐ or both ☐

Concentration of mercury (µg mercury/Nm^3 gas)	**Gas (Nm^3/year) (projection)**	**Mercury release to air, land, water, etc**
		100 % air

Thank you for taking the time to complete this survey

B. Questionnaire for Fuels
Minamata Initial Assessment Project

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

Please provide current and accurate information in the spaces provided below.

Crude oil refining

Origin of crude oil	Concentration of mercury (mg mercury/tonne)	Crude oil (tonnes/year)	Year	Mercury release to air, land, water, etc
				25 % air, 1 % water, 15 % sector specific treatment/disposal

Asphalt

Concentration of mercury (mg mercury/tonne)	Oil (tonnes/year)	Year	Mercury release to air, land, water, etc
			100 % air

Refined oil used for transportation

Number of gasoline retailers	Concentration of mercury (mg mercury/tonne)	Gasoline and Diesel (tonnes/year)	Year	Mercury release to air, land, water, etc
		-Gasoline -Diesel		25 % air, 1 % water, 15 % sector specific treatment/disposal

Liquified Petroleum Gases

Concentration of mercury (mg mercury/tonne)	LPG (tonnes/year)	Year	Mercury release to air, land, water, etc
			100 % air

Thank you for taking the time to complete this survey

C. Questionnaire for Customs Division
Minamata Initial Assessment Project

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

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

Thank you for taking the time to complete this survey.

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

	Item	Relevant HS Codes	Country of Origin, if available	g Hg/item, if available	Units imported in 2015	Units imported in 2016
1	Mercury in flasks of a net content of 34,5 kg "standard weight", of a fob value per flask of <= € 224	2805 40 10				
2	Mercury (excl. in flasks of a net content of 34,5 kg "standard weight", of a fob value per flask of <= € 224)	2805 40 90				
3	Amalgams of precious metals	2843 90 10				
4	Compounds, inorganic or organic, of mercury (excl. amalgams)	2852 00 00				
5	Inorganic compounds, n.e.s.; amalgams (excl. of precious metals)	2853 00 90				
6	Clinical thermometer containing mercury	9025 1120				
7	Clinical thermometer mercury free	9025 1920				
8	Ambient air thermometer containing mercury	9025 1180				
9	Ambient air thermometer mercury free	9025 1920				
10	Industrial and special application thermometers containing mercury	9025 1180				
11	Glass thermometers with Hg for laboratories	9025 1180				
12	Glass thermometers Hg free for laboratories	9025 1920				
13	Barometers/manometers containing mercury	9025 8020				
14	Barometers/manometers mercury free	9025 8020				

15	Hydrometers, pyrometers, hygrometers, etc., containing mercury and combinations excl. 9025 1120 and 9025 1180	9025 8080				
16	Hydrometers, pyrometers, hygrometers, etc., mercury free and combinations excl. 9025 1920	9025 8040				
17	Instrument/apparatus to measure or check the pressure of liquids/gases mercury free	9026 2000				
18	Instrument/apparatus to measure or check the pressure of liquids/gases containing mercury	9026 2000				
19	Spectrometers, spectrophotometers and spectrographs using optical radiations, such as UV, visible, IR	9027 30 00				
20	Instruments and apparatus for physical or chemical analysis, using UV, visible or IR optical radiations (exlc. spectrometers, spectrophotometers, spectrographs and gas or smoke analysis apparatus)	9027 50 00				
21	Sphygmomanometers mercury free (medical blood pressure gauges)	9025 8020				
22	Sphygmomanometers containing mercury (medical blood pressure gauges)	9025 8020				
23	Thermostats mercury free	9032 1000				
24	Thermostats containing mercury	9032 1000				
25	Discharge lamps, fluorescent, hot cathode with double ended cap	8539 3110				
26	Discharge lamps, fluorescent, hot cathode excluding with double ended cap	8539 3190				
27	Mercury or sodium vapour lamps; metal halide lamps	8539 3200				
28	Low energy consumption lamps	8539 3910				

29	Discharge lamps, other than ultra-violet, low energy and fluorescent lamps	8539 3990				
30	Ultra-violet or infra-red lamps excl. arc lamps	8539 4900				
31	Manganese dioxide primary cells or batteries	8506 1000				
32	Mercuric oxide primary cells or batteries	8506 3000				
33	Silver oxide primary cells or batteries	8506 4000				
34	Lithium primary cells or batteries	8506 5000				
35	Air-zinc primary cells or batteries	8506 6000				
36	Other primary cells/batteries	8506 8000				
37	Laptops	847 130				
38	Cell Phones	851 712				
39	LCD Screens	8528 5900				
40	LC Screens	8528 7390				
41	Cosmetics containing mercury					
42	Paint containing mercury					
43	Pesticides and biocides containing mercury					
44	Pharmaceuticals containing mercury					

D. Questionnaire for Dental Sector
Minamata Initial Assessment Project

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

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

   ☐ Elemental mercury (from a dispenser)

   ☐ Pre-capsulated mercury

   ☐ None

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

_____

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

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

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

- ☐ Reusable
- ☐ Disposable

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

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

_____

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

Thank you for taking the time to complete this survey.

E. Questionnaire for Waste Incineration
Minamata Initial Assessment Project

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

Please provide current and accurate information in the spaces provided below (or tick the appropriate boxes).

Municipal/general waste is incinerated?	Yes ☐	No ☐
Hazardous waste is incinerated?	Yes ☐	No ☐
Medical waste is incinerated?	Yes ☐	No ☐
Sewage sludge is incinerated?	Yes ☐	No ☐

Types of waste incinerated	**Concentration of mercury in incinerated waste (g mercury/tonne)**	**Waste incinerated (tonnes/year)**	**Mercury release to air, land, water, etc is dependent on the type of emissions controls present.** **<u>Output scenario</u>**
			1. No emission reduction devices ☐ 2. PM reduc, simple ESP, or similar ☐ 3. Acid gas control with limestone (or similar acid gas absorbent) and downstream high efficiency FF or ESP PM retention ☐ 4. Mercury specific absorbents and downstream FF ☐

Abbreviations: ESP – Electrostatic precipitator; FF - Fabric filter (or "bag filter"); PM – Particulate matter (or PM fil-ter).

Thank you for taking the time to complete this survey

F. Questionnaire for Waste Deposition
Minamata Initial Assessment Project

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

Please provide current and accurate information in the spaces provided below (or tick the appropriate boxes).

Are there controlled landfills/deposits? Yes ☐ No ☐

Is there informal dumping of general waste? Yes ☐ No ☐

Concentration of mercury in waste (g mercury/tonne)	Waste landfilled/dumped (tonnes/year)	Year	Mercury release to air, land, water, etc is dependent on the type of emissions controls present.
			Controlled landfill 1 % air, 0.01 % water Informal dumping 10 % air, 10 % water, 80% land

Thank you for taking the time to complete this survey

G. Questionnaire for Waste Water Treatment
Minamata Initial Assessment Project

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

Please provide current and accurate information in the spaces provided below (or tick the appropriate boxes).

Origin of waste water	**Concentration of mercury in waste water (mg mercury/m^3)**	**Waste water (m^3/year)**	**Mercury release to air, land, water, etc is dependent on the type of emissions controls present. <u>Output scenario</u>**
			1. No treatment; direct release from sewage pipe ☐ 2. Mechanical treatment only ☐ 3. Mechanical and biological (activated sludge) treatment; no land application of sludge ☐ 4. Mechanical and biological (activated sludge) treatment; 40% of sludge used for land application ☐

Thank you for taking the time to complete this survey

H. Questionnaire for Funeral Homes
Minamata Initial Assessment Project

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

Please provide current and accurate information in the spaces provided below.

Concentration of mercury (g mercury/corpse)	Corpse buried/year	Corpse cremated/year

Thank you for taking the time to complete this survey

Annex 2: UNEP TOOLKIT Calculation Spreadsheet

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

http://www.bcrc-caribbean.org/what-we-do/minamata-convention-on-mercury/saint-lucia-minamata-initial-assessment-2018/

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