



THE REPUBLIC OF PALAU MINAMATA INITIAL ASSESSMENT REPORT

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PALAU MINAMATA INITIAL ASSESSMENT REPORT

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Prepared by the Biodiversity Research Institute under the GEF Project (GEF ID: 9187):
“Development of the Minamata Initial Assessment in the Pacific Region (MIA Pacific)”.

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ABOUT THIS DOCUMENT

The Palau Minamata Initial Assessment Report was developed under the project, “Development of Minamata Initial Assessment in the Pacific”.

The project is an enabling activity for the ratification and/or implementation of the Minamata Convention on Mercury. Funding was received from the Global Environment Facility (GEF) with the United Nations Environment Programme (UNEP) acting as the Implementing Agency and the Secretariat of the Pacific Regional Environment Programme (SPREP) functioning as the Executing Agency. The Biodiversity Research Institute (BRI) was the lead technical consultancy on the project.

The report consists of:

- an inventory of mercury releases primarily based on 2021 data, performed in accordance with UN Environment's "Toolkit for identification and quantification of mercury releases", Inventory Level 2 (version November 2019);*
- an assessment of the policy, legislative and institutional framework in relation to the implementation of the Minamata Convention on Mercury;*
- assessments relating to populations at risk, education and awareness-raising strategies and;*
- recommendations and priorities for action to ensure the effective implementation of the Minamata Convention on Mercury.*

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List of Abbreviations

| Abbreviation | Full Name |
|---------------------|---|
| BAT | Best Available Techniques |
| BEP | Best Environmental Practices |
| BRI | Biodiversity Research Institute |
| CBD | United Nations Convention on Biological Diversity |
| CCFLs | Cold Cathode Fluorescent Lamps |
| CCKM | Coordination, Communication and Knowledge Management |
| CFLs | Compact Fluorescent Lamps |
| COP | Conference of the Parties |
| COVID-19 | Coronavirus Disease of 2019 |
| CSOs | Civil Society Organisations |
| ECOSOC | Economic and Social Council |
| EEFLs | External Electrode Fluorescent Lamps |
| ESM | Environmentally Sound Management |
| EQPB | Environmental Quality Protection Board |
| g | Gram |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GIC | Glass ionomer cement (dental fillings) |
| GIS | Geographic Information Systems |
| GLC | Great Lakes Commission |
| HDI | Human Development Index |
| Hg | Mercury |
| HgCl ₂ | Mercury Chloride |
| HgO | Mercury Oxide |
| HgS | Mercury Sulphide |
| HgSO ₄ | Mercury Sulfate |
| HIDLs | High Intensity Discharge Lamps |
| HPMV | High-Pressure Mercury Vapour |
| HS Code | Harmonised System Codes |
| ICM | Integrated Chemicals Management |
| ISLANDS | Implementing Sustainable Low and Non-Chemical Development in SIDS |
| Kg | Kilogram |
| Kg Hg/y | kilograms per year |
| km ² | Squared kilometres |
| Lbs | Pounds |
| LCD | Liquid Crystal Display |
| LEDs | Light-Emitting Diodes |
| LFLs | Linear Fluorescent Lamps |
| LPG | Liquid Petroleum Gas |
| M&E | Monitoring and Evaluation |
| MAPs | Mercury-Added Products |
| MEAs | Multilateral Environmental Agreements |
| Mg | Milligrams |
| MIA | Minamata Initial Assessment |
| mm | Millimetres |
| MW | Megawatts |
| NGOs | Non-Governmental Organisation |
| NPTEL | National Programme on Technology Enhanced Learning |
| ODS | Ozone Depleting Substances |

| | |
|--------|---|
| POPs | Persistent Organic Pollutants |
| PPE | Personal protective equipment |
| Ppm | Parts Per Million |
| PPUC | Palau Public Utilities Corporation |
| SDG | Sustainable Development Goals |
| SIDS | Small Island Developing States |
| SPC | Secretariat of Pacific Communities |
| SPREP | The Secretariat of the Pacific Regional Environment Programme |
| sq. km | Square Kilometres |
| SWM | Solid Waste Management |
| T | Tonne |
| THg | Total Mercury |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USA | United States of America |
| US EPA | United States Environmental Protection Agency |
| WEEE | Waste Electrical and Electronic Equipment |
| WHO | World Health Organisation |
| WTO | World Trade Organization |
| Ww | Wet Weight |
| µg/L | Microgram per litre |

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Executive Summary

The Minamata Convention on Mercury is a global multilateral environmental agreement that aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds through a number of obligations. The Minamata Convention on Mercury entered into effect on August 16, 2017, and has 147 Parties as of November 2023. In the Pacific region, 6 countries are Party to the Convention including the Republic of Palau.

To better inform needs for implementation of the Minamata Convention, Palau participated in the Minamata Initial Assessment (MIA) Project which aims to facilitate the ratification and implementation of the Convention using scientific and technical knowledge. The project is funded by the Global Environment Facility (GEF), implemented by the United Nations Environment Programme (UNEP) and executed regionally by the Secretariat of the Pacific Regional Environment Programme (SPREP). The Environmental Quality Protection Board (EQPB) acts as the National Project Focal Point for its implementation nationally.

Under the MIA Project, an inventory of mercury releases was developed using the "Toolkit for Identification and Quantification of Mercury Releases" (Toolkit) Level 2, made available by the Chemicals Branch of UNEP. Other aspects of the MIA Project included an assessment of the regulatory and institutional capacity needs for effective mercury management; identification of strategies to identify potential contaminated sites and risks to human health and the development of an awareness raising strategy for mercury management.

Results of the Inventory of Mercury Releases

It is important to note that in calculating estimations of mercury releases using the Toolkit, there were various uncertainties and complexities involved. Due to the limited available data for certain categories and the assumptions made, the estimations of mercury releases for Palau using this inventory should not be considered as definitive but rather as a guide for the identification of priorities and further assessments.

8.22 kilograms (Kg) of mercury (Hg) were determined to be released in Palau per year. The estimated mercury releases by source and by output through various release pathways identified are illustrated in Figures 1 and 2. The most significant source of mercury releases was found to be "Waste deposition/landfilling and wastewater treatment. This category accounted for 62% of national mercury releases mainly due to the estimations made for wastewater treatment which accounted for inputs of approximately 9.89 Kg of mercury per year (Kg Hg/y). This value included mercury inputs to water from other categories such as the use and disposal of consumer products which were double counted.

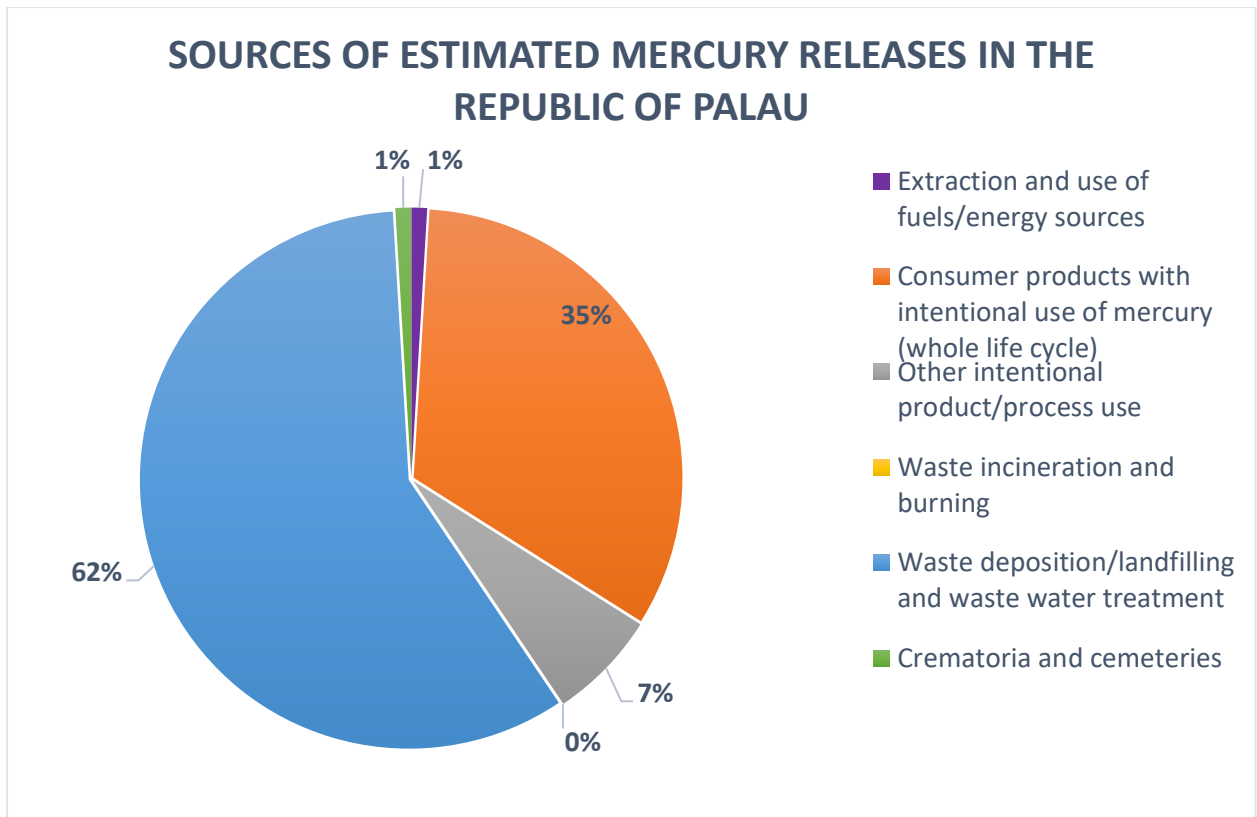


Figure 1: Pie Chart showing the main sources of estimated mercury releases in Palau.

The second highest category source of mercury releases at 35% was the consumption of products with intentional use of mercury throughout their use and disposal due to the use and disposal of electrical switches and relays with mercury and light sources with mercury which each resulted in 2.67 Kg Hg/y and 0.24 Kg Hg/y being released. “Other Intentional Products/Process Uses” referring to the preparation, use and disposal of dental mercury-amalgam fillings (0.51 Kg Hg/y) and the use and disposal of manometers and gauges with mercury (0.09 Kg Hg/y) resulted in the third largest source of mercury releases in Palau.

For the source categories, the output pathways for mercury releases were also assessed. Mercury releases to general waste were found to be the highest in comparison to other pathways at 5.00 Kg Hg/y. This was found to be mainly due to the use and disposal of consumer products with mercury and wastewater treatment. Releases to sector specific treatment/disposal accounted for the second highest output pathway for mercury releases at 2.08 Kg Hg/y due to wastewater treatment.

Palau was found to have no major sources of mercury stockpiles, supply or trade.

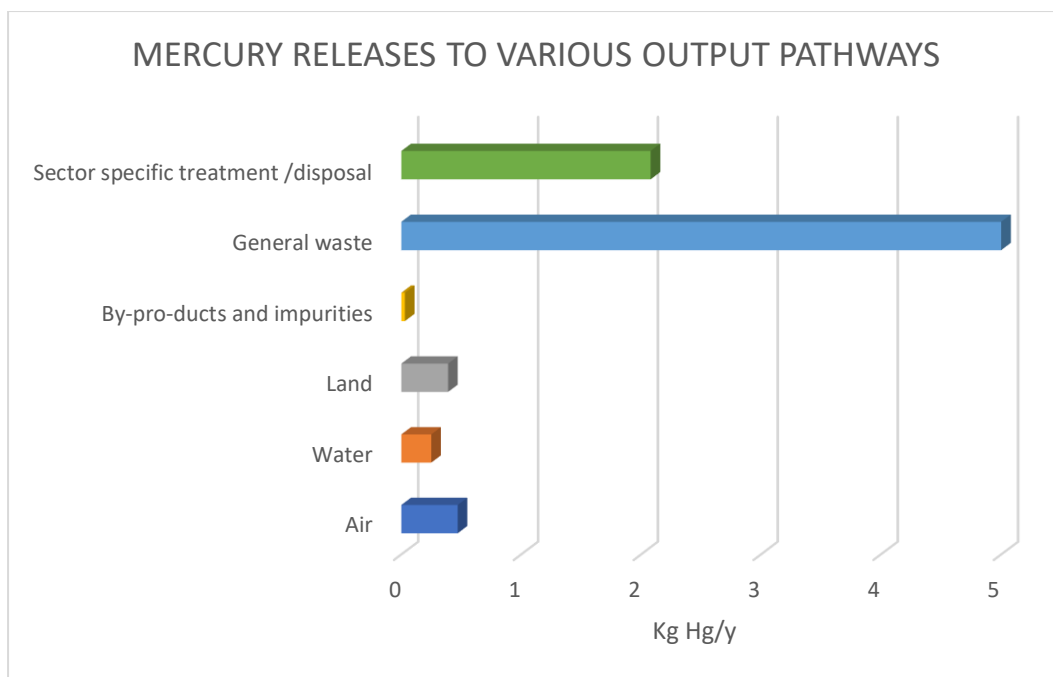


Figure 2: Bar Chart showing the mercury releases estimated according to output pathway in Palau.

Major Findings of the Policy, Regulatory and Institutional Framework Assessment

For the overall implementation of the Minamata Convention on Mercury, responsibility falls under the remit of the EQPB in coordination with several relevant stakeholders across the government sector, public and private sector as well as, non-governmental organisations and civil society organisations.

To formally recognise the obligations for Palau as a Party to the Minamata Convention on Mercury, a regulation under National Environmental Quality Protection Act should be developed by the EQPB (in coordination with relevant stakeholders) for approval by the government. This should include the prohibition of the import of mercury, mercury compounds and mercury added products as outlined under Annex A (Part II) of the Minamata Convention and for Annex A (Part II), mercury in bulk form for dental amalgam.

Coordination with the Customs Division and private sector retailers to ensure the implementation of the prohibition of mercury products and the promotion of safe mercury-free alternatives should also be carried out. Coordination with the Ministry of Health and Human Services to meet the obligations for phase down of dental amalgam and phase out of mercury added medical devices is recommended.

Other regulatory recommendations include the development of regulations under the National Environmental Quality Protection Act to include environmental standards for management of mercury releases to the land and for waste management (including mercury air emissions from waste incineration). Mercury releases to water in terms of marine and freshwater sources are already adequately addressed under the Marine and Freshwater Quality Regulations (Chapter

2401-11). The EQPB should bear the responsibility for development of mercury threshold standards with reference to guidance provided under the Minamata Convention. Coordination with the other national authorities and the health sector, where needed, to ensure management of potential mercury releases through proper health and sanitation practices should be conducted.

New or updated national plans and policies related to environmental management and strategic planning should also include the provisions of the Minamata Convention and any related agreements.

Challenges in implementation include the limited human resource capacity and technical capacity to carry out continuous activities related to mercury management. To address this, it is important to recognise the linkages between mercury issues and issues related to other hazardous or potentially harmful chemicals and how approaches can be harmonised. It is recommended that a mercury management coordination be formally established with the EQPB acting as the Chair. This working group can be linked to other environmental committees that may have been or will be established to avoid duplication of work. For example, under the GEF ISLANDS project, national stakeholders will need to coordinate related environmental work under a steering committee and sub-committees. Furthermore, it is important to recognise regional linkages that can be made to further opportunities for information exchange and capacity building, which is ongoing through agencies such as SPREP, among others.

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

Hot spots of mercury contamination exist as the direct result of the use and release of mercury in processes leading to on-site deposition, as well as the inadequate disposal of mercury-contaminated materials. Previous deposits of mercury may still have the potential to release significant amounts of mercury and pose a risk to human health and the environment. Areas that are particularly sensitive to mercury deposition- where methylation rates are highest and biomagnification in the food web is greatest, and where animals experience significant reproductive harm- are called biological mercury hotspots. These areas generally represent aquatic ecosystems or have an aquatic connection within the food web.

A map of Koror and Badeldaob, Palau was developed to identify the locations of potentially mercury contaminated sites. Further geospatial data on the other islands of Palau is recommended to provide a clearer indication of potential sites of interest for the country as a whole. Additionally, further research on the spatial distribution of potentially contaminated sites in relation to ecosystem characteristics that increase the methylation potential of mercury inputs should be conducted to inform locations prioritized for further study on the threat from mercury on human health and the environment and for future use in evaluating the effectiveness of the Minamata Convention. These, and any additional, potentially contaminated sites should be verified by the relevant national authorities.

Methylmercury, the organic form of mercury, is the most toxic form of mercury to humans as it is a neurotoxin that can cause physiological harm and behavioural disorders in people. Humans are most exposed to methylmercury through dietary consumption. Fish from the sea or freshwater systems can be a major source of methylmercury. In general, fish species that are small, short-lived, and forage low in the food web contain less methylmercury, while predatory species that are long-lived and grow larger can contain higher levels of methylmercury. Many of the fish available in the Pacific are safe to eat, although more information is needed about the mercury concentrations to better characterize how mercury is distributed in different species of fish in the waterscape of Pacific nations.

Monitoring mercury exposure to humans will help the global community to meet the requirements of the Minamata Convention on Mercury and will also help identify global biological hotspots that represent elevated levels of mercury exposure that may pose serious threats to both ecosystem and human health. Gender and occupational considerations in terms of identifying vulnerable groups for monitoring should be made.

Awareness-raising Strategies for Mercury Management

The current level of awareness on the risks associated with mercury amongst workers (such as dental professionals and waste disposal workers) and the general public is not considered to be high and measures should be adapted to educate these groups on the issue. Under the MIA Project, a brief animated awareness raising video was developed for dissemination in Palau. The video aims to educate the general public on the potentially mercury-added household products that may be present, the need for safe disposal and the promotion of mercury-free alternatives that are already popular on the local market. It is recommended that the video be shared widely via social media by EQPB and other national stakeholder organizations.

To educate key stakeholders on the estimated sources of mercury releases and recommendations for mercury management developed under the project, a technical briefing document that summarizes the main findings of the MIA Project was developed by BRI.

Additionally, through Palau's participation in the GEF ISLANDS Programme, further mercury-related activities for information dissemination, inclusive of gender considerations, will be carried out. The materials developed under this project and the ongoing GEF ISLANDS Programme, can be utilized in future public education campaigns on environmental awareness.

In terms of mercury's potential impact on human health and possible exposure through diets, fish consumption guidelines that are based on scientific research are recommended to assist vulnerable populations in determining the recommended frequency in consuming fish that considers their health benefits versus potential mercury risks.

Coordination with other relevant governmental, private and non-governmental organizations such as the Fisheries Division and the Ministry of Health and Human Services is recommended to further promote mercury management awareness.

Priority Areas for Consideration in the Implementation of the Minamata Convention

Recommendations for consideration in the implementation of the Minamata Convention may include actions to:

1. Develop a Regulation to formally recognise the obligations of the Minamata Convention and facilitate its implementation.
2. Establish a Coordinating Mechanism for mercury management.
3. Implement measures to address identified sources of mercury release through:
 - a. Promotion of the continued phase-out and phase down of mercury-added products and;
 - b. Ensuring Best Available Techniques/Best Environmental Practices (BAT/BEP) implementation for monitoring and preventing mercury releases from sources such as landfills and waste incinerators.
4. Public awareness and sensitisation of relevant stakeholders on mercury issues
5. Strengthen understanding of mercury issues in Palau through monitoring programmes.

Under the ongoing GEF-funded programme, Implementing Sustainable Low and Non-Chemical Development in Small Island Developing States (ISLANDS), Palau will also benefit from the development of draft model legislation to control mercury-added products for use by Pacific SIDS that can be tailored for adoption, and the provision of support for the sound repackaging, shipping, collection, and disposal of mercury waste.

INTRODUCTION

Mercury and the Minamata Convention on Mercury

Mercury (symbol: Hg), also known as quicksilver, is a natural element that exists in the earth's crust. Emissions of mercury to the environment may occur due to volcanic eruptions and other natural occurrences, but the majority of mercury releases have been found to be due to anthropogenic activities such as primary mercury mining, and re-emissions of mercury already in the environment, mainly as a result of previous human activity (UNEP, 2019a).

The release of mercury to the environment is of serious concern due its highly toxic and persistent nature, which can negatively affect human health and the environment. Mercury has been listed by the World Health Organisation (WHO) as one (1) of the top ten (10) chemicals or groups of chemicals of major health concern (WHO, 2017).

Mercury exists in three (3) main forms:

1. *Elemental or metallic mercury* which is a silvery-coloured liquid at room temperature and standard pressure. This form has been used in a variety of activities such as artisanal and small-scale gold mining (ASGM) in which mercury is used for its ability to form an amalgam with gold particles. It has also been used in the manufacture of some consumer products such thermometers, dental amalgam, fluorescent light bulbs, and some electrical switches.
2. *Inorganic mercury compounds* which are formed when mercury bonds with other chemicals to form compounds or salts. This may occur naturally or due to man-made activities for use in several industrial processes and in the manufacture of products.
3. *Organic mercury compounds* which are formed when mercury combines with carbon to form compounds. The most toxic organic mercury compound is methylmercury (MeHg) which typically forms in water or sediment when anaerobic bacteria convert elemental or inorganic mercury to MeHg. This form tends to bioaccumulate in the food chain and humans are typically exposed to MeHg consumption of certain contaminated fish or shellfish over a period of time (UNEP, 2019b).

Exposure to mercury can range from short-term effects such as headache, dizziness, skin and eye irritations to more serious and long-term impacts on the nervous, digestive, respiratory, renal and immune systems, and may be fatal depending on the level and length of exposure (WHO, 2017). The most vulnerable populations to the harmful impacts of mercury include children and pregnant or breastfeeding women as mercury can cross into the placenta and breastmilk.

The effects of mercury on ecosystem health can also be detrimental as studies have shown that the growth, behaviour and reproduction of fish with high concentrations of mercury can be negatively impacted. This can in turn impact the food web as wildlife who then regularly consume mercury-contaminated fish have been shown to have decreased reproductive success (BRI, 2019). Aquatic ecosystems such as beaches, lakes, mangroves among others, are particularly sensitive to mercury accumulation.

In recognising the need to address the issues posed by mercury, the global multilateral environmental agreement, the Minamata Convention on Mercury, was developed. The Convention aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds through a number of obligations that, among other things, regulate:

- mercury supply, sources and trade;
- mercury added products;
- manufacturing processes;
- artisanal and small scale gold mining;
- interim storage and disposal of mercury and mercury compounds;
- mercury waste management;
- mercury emissions and releases management, among other activities.

The Minamata Convention on Mercury entered into effect on August 16, 2017, and has 147 Parties as of November 2023. In the Pacific region, six (6) countries are Party to the Convention, including Palau.

Project Background

The MIA Project aims to facilitate the ratification and implementation of the Minamata Convention on Mercury using scientific and technical knowledge in conducting an inventory of mercury releases (and emissions¹). The development of an inventory of mercury releases will inform countries of their national mercury sources and subsequently assist in identifying actions to increase their capacity in mercury management.

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

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

¹ Under the Minamata Convention, the term "releases" is typically related to mercury released to land and water while the term "emissions" refers to mercury released to air. Under the 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.

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

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

Further details on the project outputs are detailed in Table 1.

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

| Project Component | Project Output |
|---|--|
| Global technical support and capacity building for MIA development | 1.1 Technical assistance provided to the PALAU to develop the MIA while building sustainable foundations for its future implementation |
| Development and validation of the Minamata Initial Assessment | 2.1 Identified and strengthened national coordination mechanism dealing with mercury management that will guide the project implementation |
| | 2.2 National institutional and regulatory framework and national capacities on mercury management assessed |
| | 2.3 National inventories of mercury sources and releases developed using the UN Environment Mercury Toolkit Level II and strategy for the identification of mercury contaminated sites developed |
| | 2.4 Challenges, needs and opportunities to implement the Minamata Convention assessed and recommendations to ratify and implement the Minamata Convention developed |
| | 2.5 MIA validated by national stakeholders |
| Monitoring and Evaluation | 3.1 Status of project implementation and probity of use of funds accessed on a regular basis and communicated to the GEF |
| | 3.2 Independent terminal evaluation developed and made publicly available |

Chapter 1: National Background Information

1.1 Geography and Population

The Republic of Palau is a tropical small island nation comprising of 340 individual coral and volcanic islands that form 6 island groups spread across 466 square kilometres (km²) in the Western Pacific Ocean (OPS, 2006). Palau is made up of varying geology with the largest island, Babeldaob (also Babelthuap), being volcanic along with other islands such as Koror and Malakal islands (OPS, 2006). The volcanic islands have rich soil resulting in dense vegetation and agriculture. Contrastingly, the other islands in Palau are mostly low-lying coral and limestone islands which have more sparse vegetation due to the more porous soil, higher salinity and limited land but have rich coral reefs (OPS, 2006).

The geology of Palau has influenced population density as the majority of the population reside in islands with more access to agriculture. 8 islands are inhabited and most of the population reside in the main island group called the Palau Islands (Figure 3). The total population of Palau as of 2021 was 18,174 according to the World Bank Database (2023) with approximately 65% of the population residing in Koror, the former capital located in the Palau Islands group. The current capital of Ngerulmud is located on Babeldaob.



Figure 3: Map of Palau (GIS Geography, 2023)

Approximately 71% of the population are native-born with the remaining percentage being migrants from countries such as the Philippines, Bangladesh and China. The official languages spoken are English and Palauan. Culturally, the Palau Islands have distinctly different practices compared to the Southwest Islands which have closer links to the other islands such as Yap due to their shared history, language and migration patterns (OPS, 2006). Influences from previous occupation by Spain, Germany and Japan can be seen in words adopted into the local language and other cultural aspects. Overall, women play a central role in society and have traditionally held positions of power within their families, clans and communities; however, there are still some areas where they are underrepresented in decision-making roles such as in Parliament (UN Women, 2022). Based on the latest national population census, the population of natives to Palau is relatively gender-balanced across the age groups while the migrant population tend to have more males in the 15–44 years age group (working age).

1.2 Political, Economic and Legal Profile

Palau is a democratic republic with a constitutional government system. Environmental protection are key provisions highlighted in the Constitution reflecting the deep traditional heritage of conservation (SPREP and NWS EDO, 2018). The overall government is made up of its national government and 16 state governments with an elected President that serves on a 4-year term system. Each state also elects its own governor and legislature. The legal system in Palau is derived from its Constitution, the Palau National Code, and the respective State ordinances/statutes (SPREP and NWS EDO, 2018).

The legislative branch of the government is the National Congress of Palau (the Olbiil Era Kelulau), which as of April 2022, had 6.9% of elected seats occupied by women (UN Women, 2022). Traditional government structures also exist in the form of the Council of Chiefs, a group of traditional chiefs from each state that advises the President on matters related to how traditional laws apply to Palau’s formal legal system (SPREP and NWS EDO, 2018).

Palau gained independence from the United States of America (USA) and an agreement, the Compact of Free Association (followed by a Compact Review Agreement), was established between the Government of Palau and the USA where financial assistance is provided by the USA in exchange for the USA maintaining national defence and access rights (SPREP and NWS EDO, 2018).






Palau’s per capita income is among the highest in the Pacific at approximately US \$16,000 prior to the onset of the COVID-19 pandemic (PSDI, 2021). Tourism, especially eco-tourism, is a major contributor to Gross Domestic Product (GDP) at approximately 40%. The public administration sector is also a contributor, funded largely through financial aid provided through the Compact Review Agreement (PSDI, 2021). Agriculture and fishing are other sectors in Palau that add to the GDP.

1.3 Environmental Overview

Environmental protection is of high importance to the people of Palau and has been reflected in their practices. The marine environment, especially coral reefs are relied on for sustainable and commercial fishing as well as for tourism (NEPC, 2019). As such, Palau has extensive marine conservation laws in place to ensure their sustainable use. Other habitats such as mangroves and forests, have been noted to be in generally good conditions (NEPC, 2019). As a Small Island Developing State (SIDS), Palau is among the most vulnerable to the impacts of climate change and rising-sea levels.

To enhance national capacities to address environmental challenges and protect the environment, Palau is a Party to several Multilateral Environment Agreements (MEAs). A list of some relevant MEAs that Palau is a Party to is provided in Table 2, including the Minamata Convention on Mercury.

Table 2: Multilateral environmental agreements to which Palau is a Party

| Treaty | | Year of Becoming a Party |
|---|---|--------------------------|
|  | Minamata Convention on Mercury | 2017 |
|  | Basel Convention on the Control of the Transboundary Movement of Hazardous Waste and their Disposal | 2011 |
|  | Stockholm Convention on Persistent Organic Pollutants | 2011 |
|  | Convention on Biological Diversity | 1994 |
|  | Paris Agreement (as part of United Nations Framework Convention on Climate Change) | 2016 |

Chapter 2: Mercury Inventory and Identification of Emissions and Releases

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

2.1.1 Mercury Release Source Types Present

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

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

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

| Toolkit Category # | Source category | Source presence (Y/N/?) |
|--------------------|--|-------------------------|
| 5.4 | Intentional use of mercury as an auxiliary material in industrial processes | |
| 5.4.1 | Chlor-alkali production with mercury-technology | N |
| 5.4.2 | VCM (vinyl-chloride-monomer) production with mercury-dichloride (HgCl ₂) as catalyst | N |
| 5.4.3 | Acetaldehyde production with mercury-sulphate (HgSO ₄) as catalyst | N |
| 5.4.4 | Other production of chemicals and polymers with mercury compounds as catalysts | N |
| 5.5 | Consumer products with intentional use of mercury | |
| 5.5.1 | Thermometers with mercury | Y |
| 5.5.2 | Electrical and electronic switches, contacts and relays with mercury | Y |
| 5.5.3 | Light sources with mercury | Y |
| 5.5.4 | Batteries containing mercury | Y |
| 5.5.5 | Polyurethane with mercury catalysts | N |
| 5.5.6 | Biocides and pesticides | N |
| 5.5.7 | Paints | N |
| 5.5.8 | Pharmaceuticals for human and veterinary uses | N |
| 5.5.8 | Cosmetics and related products | ? |
| 5.6 | Other intentional products/process uses | |
| 5.6.1 | Dental mercury-amalgam fillings | Y |
| 5.6.2 | Manometers and gauges | Y |
| 5.6.3 | Laboratory chemicals and equipment | N |
| 5.6.4 | Mercury metal use in religious rituals and folklore medicine | N |
| 5.6.5 | Miscellaneous product uses, mercury metal uses and other sources | N |
| 5.7 | Production of recycled metals | |
| 5.7.1 | Production of recycled mercury ("secondary production) | N |
| 5.7.2 | Production of recycled ferrous metals (iron and steel) | N |
| 5.7.3 | Production of other recycled metals | N |
| 5.8 | Waste incineration | |
| 5.8.1 | Incineration of municipal/general waste | N |
| 5.8.2 | Incineration of hazardous waste | N |
| 5.8.3 | Incineration of medical waste | Y |
| 5.8.4 | Sewage sludge incineration | N |
| 5.8.5 | Informal waste burning | Y |
| 5.9 | Waste deposition/landfilling and wastewater treatment | |
| 5.9.1 | Controlled landfills/deposits | Y |
| 5.9.2 | Diffuse deposition under some control | N |
| 5.9.3 | Informal local deposition of industrial production waste | N |

| Toolkit Category # | Source category | Source presence (Y/N/?) |
|--------------------|-----------------------------------|-------------------------|
| 5.9.4 | Informal dumping of general waste | Y |
| 5.9.5 | Wastewater system/treatment | Y |
| 5.10 | Cremation and cemeteries | |
| 5.10.1 | Crematoria | N |
| 5.10.2 | Cemeteries | Y |

2.1.2 Summary of Estimated Mercury Inputs to Society

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

Mercury inputs to Palau for the source categories identified as being present in Table 4 are shown below in Table 4.

Table 4: Summary of mercury inputs to Palau

| Source category | Estimated Hg Input (Kg Hg/y) |
|--|---------------------------------|
| Extraction and use of fuels/energy sources | |
| Mineral Oil- Extraction, refining and use | 0.05 |
| Biomass fired power and heat production | No data available |
| Consumer products with intentional use of mercury | |
| Thermometers with mercury | Assumed to be negligible |
| Electrical and electronic switches, contacts and relays with mercury | 2.67 |
| Light sources with mercury | 0.24 |
| Batteries containing mercury | No data available |
| Cosmetics with mercury catalysts | No data available |
| Other intentional products/process uses | |
| Dental mercury-amalgam fillings | 0.51 |
| Manometers and gauges | 0.09 |
| Waste incineration | |
| Incineration of medical waste | No data available |
| Informal waste burning | Assumed to be negligible |
| Waste deposition/landfilling and wastewater treatment | |

| Source category | Estimated Hg Input (Kg Hg/y) |
|-----------------------------------|---------------------------------|
| Controlled landfills/deposits | 0.20 |
| Informal dumping of general waste | Assumed to be negligible |
| Wastewater system/treatment | 9.89 |
| Cremation and cemeteries | |
| Cemeteries | 0.08 |

2.1.3 Summary of Mercury Releases

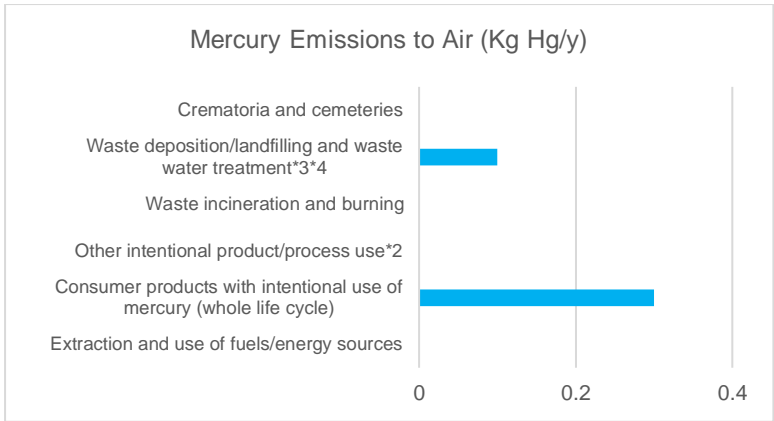
Mercury releases are to air (the atmosphere), water (marine and freshwater bodies, including via wastewater systems), land, general waste, and sector specific waste treatment/disposal. An additional output pathway is "by-products and impurities" which designates mercury flows back into the market in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

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

| Calculation Result Type | Description <i>(NOTE: Not all examples provided are relevant to PALAU but are included for general reference)</i> |
|-----------------------------|--|
| Estimated Hg input, Kg Hg/y | The standard estimate of the amount of mercury entering this source category with input materials, for example calculated mercury amount in coal used annually in the country for combustion in large power plants. |
| Air | Mercury emissions to the atmosphere from point sources and diffuse sources from which mercury may be spread locally or over long distances with air masses; for example, from: <ul style="list-style-type: none"> • Point sources such as coal fired power plants, metal smelter, waste incineration; • Diffuse sources such as small-scale gold mining, informal burning of waste with fluorescent lamps, batteries, thermometers. |
| Water | Mercury releases to aquatic environments and to wastewater systems; point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes, etc.). for example, releases from: <ul style="list-style-type: none"> • Wet flue gas cleaning systems on coal fired power plants; • Industry, households, etc. to aquatic environments; • Surface run-off and leachate from mercury contaminated soil and waste dumps. |

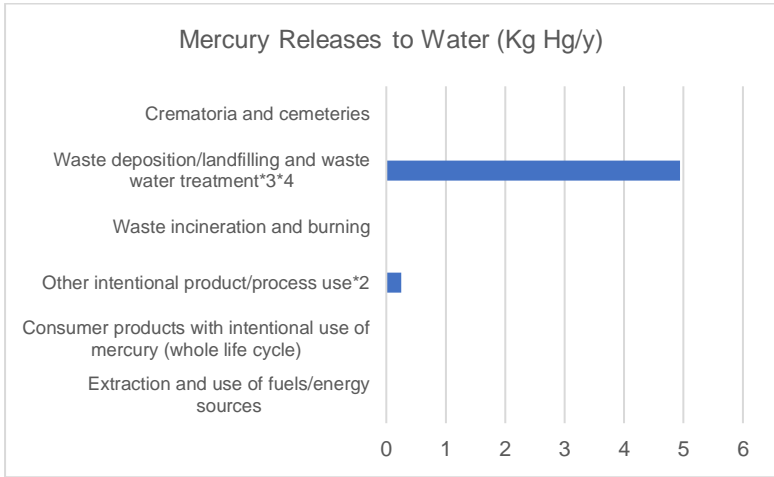
| Calculation Result Type | Description <i>(NOTE: Not all examples provided are relevant to PALAU but are included for general reference)</i> |
|---|--|
| Land | <p>Mercury releases to the terrestrial environment: General soil and ground water. For example, releases from:</p> <ul style="list-style-type: none"> • Solid residues from flue gas cleaning on coal fired power plants used for gravel road construction; • Uncollected waste products dumped or buried informally; • Local un-confined releases from industry such as on-site hazardous waste storage/burial; • Spreading of sewage sludge with mercury content on agricultural land (sludge used as fertilizer); • Application on land, seeds or seedlings of pesticides with mercury compounds. |
| By-products and impurities | <p>By-products that contain mercury, which are sent back into the market and cannot be directly allocated to environmental releases, for example:</p> <ul style="list-style-type: none"> • Gypsum wallboard produced from solid residues from flue gas cleaning on coal fired power plants; • Sulphuric acid produced from desulphurization of flue gas (flue gas cleaning) in non-ferrous metal plants with mercury trace concentrations; • Chlorine and sodium hydroxide produced with mercury-based chlor-alkali technology; with mercury trace concentrations; • Metal mercury or calomel as by-product from non-ferrous metal mining (high mercury concentrations). |
| General waste | <p>General waste: Also called municipal waste in some countries. Typically, household and institution waste where the waste undergoes a general treatment, such as incineration, landfilling or informal dumping. The mercury sources to waste are consumer products with intentional mercury content (batteries, thermometers, fluorescent tubes, etc.) as well as high volume waste like printed paper, plastic, etc., with small trace concentrations of mercury.</p> |
| Sector specific waste treatment /disposal | <p>Waste from industry and consumers which is collected and treated in separate systems, and in some cases recycled; for example:</p> <ul style="list-style-type: none"> • Confined deposition of solid residues from flue gas cleaning on coal fired power plants on dedicated sites; • Hazardous industrial waste with high mercury content, which is deposited in dedicated, safe sites; • Hazardous consumer waste with mercury content, mainly separately collected and safely treated batteries, thermometers, mercury switches, lost teeth with amalgam fillings, etc.; • Confined deposition of tailings and high-volume rock/waste from extraction of non-ferrous metals. |

Table 6 summarises mercury releases to the various output pathways in Palau based on Toolkit calculations using mainly 2021 data and default values or extrapolations where data was not available. Details on how the release values were obtained are included in the respective subsections of this report. Source categories that were not identified as being present in Palau are not included in the table.



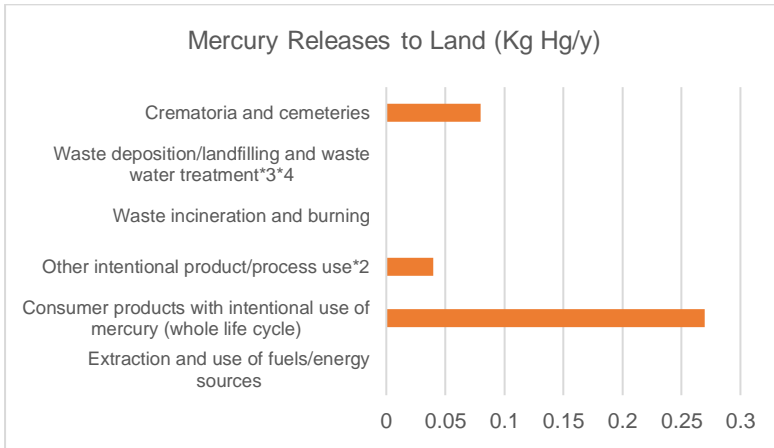
Consumer Products with mercury was found to contribute the most to air emissions at 0.28 Kg Hg/y.

Figure 4: Mercury Emissions to Air Output Pathway from Present Mercury Source Categories



Releases from wastewater treatment sources accounted for 4.94 Kg Hg/y releases to water. Other intentional product/process use which refers to the preparation, use and disposal of dental amalgam fillings as well as manometers and gauges resulted in 0.24 Kg Hg/y of releases to water.

Figure 5: Mercury Releases to Water Output Pathway from Present Mercury Source Categories



The disposal of consumer products contributed the most to estimated releases to land at 0.27 Kg Hg/y followed by releases from cemeteries at 0.08 Kg Hg/y.

Figure 6: Mercury Releases to Land Output Pathway from Present Mercury Source Categories

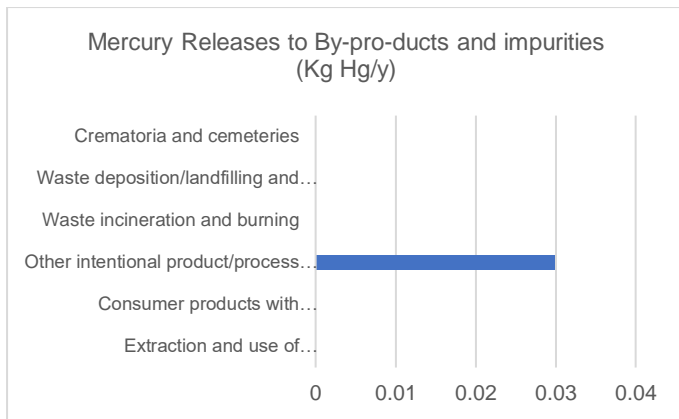


Figure 7: Mercury Releases to By-products and Impurities Output Pathway from Present Mercury Source Categories

Other intentional products/process uses contributed to the main quantifiable releases to by-products and impurities at 0.03 Kg Hg/y.

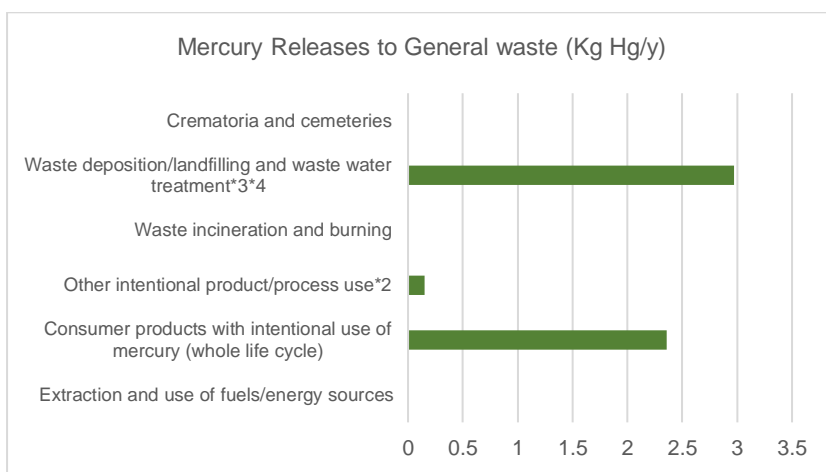


Figure 8: Mercury Releases to General Waste Output Pathway from Present Mercury Source Categories

Wastewater treatment resulted in the highest estimated releases to general waste followed by Consumer Products with mercury which was found to contribute the most to general waste releases at 2.36 Kg Hg/y followed by 0.15 Kg Hg/y from Other intentional products/process use.

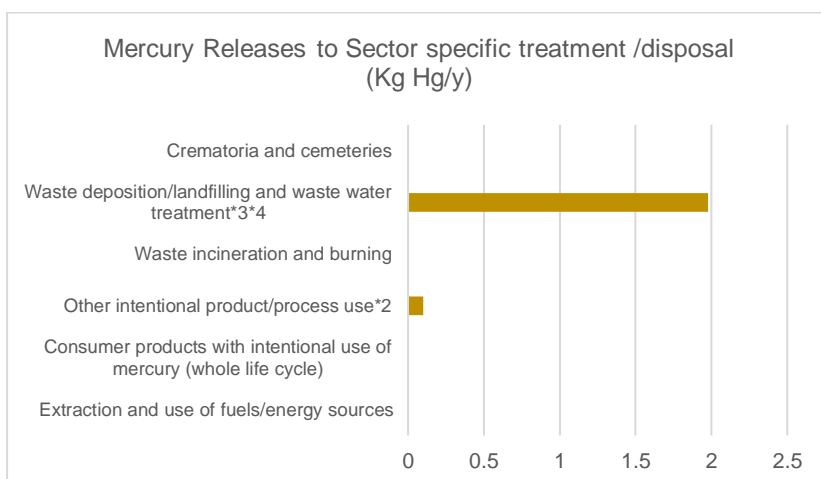


Figure 9: Mercury Releases to Sector Specific Treatment/Disposal Output Pathway from Present Mercury Source Categories

Wastewater treatment accounted for 1.98 Kg Hg/y being released to sector-specific treatment/disposal pathways. Other intentional product/process uses was found to be responsible for 0.10 Kg Hg/y of releases.

Table 6: Summary of mercury releases in Palau for 2021

| Source category | Calculated Hg output, Kg/y | | | | | |
|---|----------------------------|-------------|-------------|----------------------------|---------------|------------------------------------|
| | Air | Water | Land | By-products and impurities | General waste | Sector specific treatment/disposal |
| Extraction and use of fuels/energy sources | | | | | | |
| Mineral oils - extraction, refining and use | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Biomass fired power and heat production | - | - | - | - | - | - |
| Consumer products with intentional use of mercury | | | | | | |
| Thermometers with mercury | - | - | - | - | - | - |
| Electrical switches and relays with mercury | 0.27 | 0.00 | 0.27 | 0.00 | 2.14 | 0.00 |
| Light sources with mercury | 0.01 | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 |
| Batteries with mercury | - | - | - | - | - | - |
| Cosmetics and related products with mercury | - | - | - | - | - | - |
| Other intentional product/process use | | | | | | |
| Dental mercury-amalgam fillings | 0.01 | 0.22 | 0.04 | 0.03 | 0.10 | 0.10 |
| Manometers and gauges with mercury | 0.01 | 0.03 | 0.00 | 0.00 | 0.05 | 0.00 |
| Waste incineration^{*3} | | | | | | |
| Incineration of medical waste | - | - | - | - | - | - |
| Informal waste burning | - | - | - | - | - | - |
| Waste deposition/landfilling and wastewater treatment | | | | | | |
| Controlled landfills/deposits ^{*3} | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Informal dumping of general waste ^{*1*3} | - | - | - | - | - | - |
| Waste water system/treatment ^{*2} | 0.00 | 4.94 | 0.00 | 0.00 | 2.97 | 1.98 |
| Crematoria and cemeteries | | | | | | |
| Cemeteries | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 |
| SUM OF QUANTIFIED INPUTS AND RELEASES^{*1*2*3*4} | 0.47 | 0.25 | 0.39 | 0.03 | 5.00 | 2.08 |

Notes:

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

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

*3: 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.

**4 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.*

Total mercury releases in Palau in 2021 were estimated to be 8.22 Kg Hg/y.

The following sub-categories were estimated to be the top sources of mercury releases once double-counting for releases from the waste categories were subtracted:

1. Electrical switches and relays with mercury (2.67 Kg Hg/y)
2. Dental mercury-amalgam fillings (0.51 Kg Hg/y)
3. Light sources with mercury (0.24 Kg Hg/y)

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.

There are no industries in Palau, which generate or use mercury as described by the Convention. Therefore, there are no such stockpiles in the country and no supply and trade in this regard.

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

2.2.1 Use of Mineral Oils

Through the extraction, refining and use of various fuels, small amounts of mercury impurities which may be naturally present, can be released into the environment. In Palau, no extraction or refining of fuel sources occurs but fuels such as diesel, gasoline and aviation fuel are imported for electricity generation and transportation purposes.

When oil products are combusted, mercury is primarily emitted to the air. Mercury concentrations in oils vary widely based on their source geology and in order to estimate potential releases in the Toolkit, globally available data on mercury concentrations in oils assessed over the years was analysed.

Data Collection and Assessment

For collection of data for use of mineral oils, questionnaires were sent to the three (3) main energy suppliers in Palau. Responses were received from one (1) supplier. Data received from this supplier was entered into the Toolkit noting that that this is likely an underestimation of mineral oils used per year. The main types of fuel noted were unleaded gasoline and jet fuel for transportation while diesel fuel was assumed to be used for power generation. All fuel types were imported from Singapore.

For input into the Toolkit, these values were converted to tonnes per year (t/y) using the Unit Conversion tab in the UNEP Toolkit and the following conversions². Table 7 summarises the converted values used for data entry.

- 1 gallon [U.S.] of kerosene type jet fuel to tonne of oil equivalent = 0.00340 tonne of oil equivalent
- 1 gallon [U.S.] of automotive gasoline to tonne of oil equivalent = 0.00315 tonne of oil equivalent
- 1 gallon [U.S.] of diesel oil to tonne of oil equivalent = 0.00300 tonne of oil equivalent.

Table 7: Summary of Estimated Imports of Fuels in 2021 Converted to tonnes/year.

| Type of Fuel | Estimated Use of Fuels per year (gallons/year) | Estimated Use of Fuels (tonnes/year) |
|--------------------------|--|--------------------------------------|
| Diesel | 4,000,000 | 13,998 |
| Unleaded Gasoline | 2,700,000 | 8,497 |
| Jet Fuel | 335,000 | 1,138 |

Table 8 summarises the mercury inputs and releases to Palau from the extraction and use of mineral oils and natural gas. The input factors and output distribution factors used to estimate mercury releases were obtained from the Toolkit.

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

| Use of Mineral Oils | Unit | Transportation and other uses | Other Oil Combustion Facilities (Powerplant) |
|---|----------------|-------------------------------|--|
| Activity rate | t/y | 9,635 | 13,998 |
| Input factor for phase | mg Hg/t | 2.00 | 2.00 |
| Calculated input to phase | Kg Hg/y | 0.02 | 0.03 |
| Output distribution factors for phase: | | | |
| - Air | N/A | 1.00 | 1.00 |
| - Water | N/A | - | - |
| - Land | N/A | - | - |
| - Products | N/A | - | - |
| - General waste treatment | N/A | - | - |
| - Sector specific waste treatment | N/A | - | - |

² Conversion factors found at: <https://www.convertunits.com/from/gallon/to/tonne+of+oil+equivalent>

| Use of Mineral Oils | Unit | Transportation and other uses | Other Oil Combustion Facilities (Powerplant) |
|--|---------|-------------------------------|--|
| Calculated outputs/releases to: | | | |
| - Air | Kg Hg/y | 0.02 | 0.03 |
| - Water | Kg Hg/y | - | - |
| - Land | Kg Hg/y | - | - |
| - Products | Kg Hg/y | - | - |
| - General waste treatment | Kg Hg/y | - | - |
| - Sector specific waste treatment | Kg Hg/y | - | - |

Specific mercury content data was not available for any of the fuel sources obtained for the inventory. The recommended input factor provided in the Toolkit was used for calculations.

2.2.2 Biomass fired power and heat production.

Biomass may naturally contain mercury as an impurity which can be released during burning as a fuel source (UNEP, 2019a). Vegetation also absorbs atmospheric mercury overtime which is readily re-released to the air upon combustion (UNEP, 2019a).

Data Collection and Assessment

While approximately 75% of households use gas stoves as their main means of cooking, biomass burning (in the form of “purchased wood or charcoal, wood cut by household members on their property or elsewhere, driftwood, sawmill or construction scraps, or the like”) may be used in some cases (Ministry of Finance, 2014). Quantifiable data on the amount of biomass that may be used for cooking purposes was not available at the time of the inventory. Based on population size, it was assumed that mercury releases from this source would be negligible.

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

Mercury has been added intentionally in several consumer products over the years due to its useful properties such as its high density and low vapour pressure. At each stage of the lifecycle of a product, mercury may be released due to the type of manufacturing processes used, handling procedures and disposal methods (UNEP, 2019a). In recent years, global trends have indicated that production and use of mercury-added products has greatly reduced due to more awareness of the dangers posed by mercury and technological advancements that have made mercury-free alternatives more accessible. While mercury releases from production and use are expected to be reduced, releases from the disposal of products over the years is also a factor considered in the Toolkit. Disposal of the products after use may occur directly to soil through landfills and informal dumping sites, to the air via waste incineration and informal burning, and to water through wastewater treatment, landfill leachate and runoff, according to the types and efficiency of waste collection and handling procedures implemented (UNEP, 2019a).

In Palau, no production of products containing mercury occurs. However, items may be imported, used and disposed of locally.

2.3.1 Use and Disposal of Thermometers

Mercury has been used in thermometers due to its various properties such as a high boiling point and high coefficient of expansion (UNEP, 2019a). Since the mercury in thermometers is contained within a sealed containment, it does not pose any risk during use. However, once broken or cracked, the mercury contained within can be emitted to the air as vapours or released to the land and to water (UNEP, 2019a).

Data Collection and Assessment

In the past ten (10) years, mercury-free digital thermometers have become more common on the global and national market. Additionally, due to the onset of the COVID-19 pandemic in 2020, mercury-free contactless infrared thermometers were promoted. Observations made in Palau reflected the global trend towards mercury-free thermometer varieties. While confirmation of the complete phase-out of mercury-added thermometers could not be confirmed at the time of the inventory development, it was assumed that mercury releases from this source would be due to mercury added thermometers disposed of over the past 10 – 20 years. Based on population size, it was assumed that these releases would be negligible, as specific data to confirm numbers of thermometers within the country was unavailable.

2.3.2 Use and Disposal of Electrical Switches and Relays

Mercury has been used in some switches and relays, generally found in various electronic equipment due to its high density, conductivity and sensitivity to temperature (UNEP, 2019a). Over the past twenty (20) years, mercury-free alternatives have become more common on the market (examples shown in Table 9). However, due to the long service life of mercury switches and relays (ranging from 10-50 years, primarily based on the life span of the equipment in which the switch or relay is contained), mercury from these items is expected to be present in wastes for many years despite the use of alternative products.

Table 9: Mercury-added Electrical Switches and Relays and their Alternatives (IMERC, 2014; IMERC, 2018).

| Potentially Mercury-added Component or Product | Mercury-free Alternative(s) |
|--|--|
| Float switch | Mechanical, magnetic dry reed, optical, conductivity, metallic ball, sonic or ultrasonic, pressure transmitter, alloy, thermal, and capacitance float switches |
| Tilt switch | Metallic ball, electrolytic, mechanical, solid-state, and capacitance tilt switches; potentiometers |
| Pressure switch | Mechanical or solid-state switches |
| Temperature switch | |
| Mercury displacement relay | Dry magnetic reed, electro-mechanical, and solid-state relays; silicon-controlled rectifiers |
| Mercury wetted reed relay | |
| Mercury contact relay | |

| | |
|--------------------|---|
| Flame sensor | Electronic ignition systems |
| Mercury thermostat | Electromechanical Thermostats (e.g., reed switch, snap-switch etc.); Digital Thermostat (electronic programmable) |

Data Collection and Assessment

As electrical switches and relays are typically found as components of larger products, determining quantities that are in use in a country and their mercury content is extremely difficult. Default Toolkit calculations were used to estimate mercury input to society and output from this category. The calculations utilized the number of inhabitants and the percent electrification rate from 2001 to give a more accurate estimation of the historical consumption and 2021 disposal rates. Table 10 details the factors used to estimate mercury releases to various output pathways from the use and disposal of mercury-added electrical switches and relays.

Table 10: Analysis of mercury inputs and outputs from the historical use and disposal of mercury-added electrical switches and relays.

| Electrical Switches and Relays with Mercury | Unit | Use and Disposal of Electrical Switches and Relays |
|--|--|--|
| Activity rate | inhabitants (2001) | 19,390 |
| Input factor for phase | Percent of population with access to electricity | 98.2 |
| | g Hg/y*inhabitant | 0.14 |
| Calculated input to phase (no separate collection. Waste handling controlled) | Kg Hg/y | 2.67 |
| 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 | 0.27 |
| - Water | Kg Hg/y | - |
| - Land | Kg Hg/y | 0.27 |
| - Products | - | - |
| - General waste treatment | Kg Hg/y | 2.14 |
| - Sector specific waste treatment | - | - |

2.3.3 Use and Disposal of Light Sources

Mercury has been used in various discharge lamps including linear fluorescent tubes (LFLs), compact fluorescent lamps (CFLs), mercury vapour lamps, high-pressure sodium lamps and metal halide lamps. CFLs and LFLs are typically used for general lighting in residences and buildings, while high-pressure sodium lamps and metal halide lamps can be used in streetlights and lights utilized in stadiums. The amount of mercury contained in these light sources vary and depend on the type of bulb. While mercury-free Light Emitting Diode (LED) bulbs have become more popular in recent years, mercury added lighting devices are still found in stock globally.

Mercury is not considered a threat to the environment when it is contained within the glass tube of the bulbs. However, when lighting devices are broken accidentally or through disposal, mercury can be released into the environment (UNEP, 2019a).

Lighting products containing mercury are not produced in Palau, however, they are imported.

Data Collection and Assessment

Import data on lighting devices being imported over the past five (5) years was not available at the time of the inventory.

Site visits to two (2) major retail stores in Koror, Palau were conducted and it was found that mercury-free LED single-ended and linear bulbs were the predominant types found, although CFLs and LFLs were also noted in lesser quantities. Most lighting fixtures sold were LED-compliant.

In terms of High Intensity Discharge Lamps (HIDLs), LED and LED-compliant lighting fixtures appeared to be the more commonly available. Based on this observation, the number of mercury-added metal halide lamps were assumed to be negligible.

In order to estimate the number of CFLs and LFLs sold in 2021 for entry in the Toolkit, assumptions based on population data and retail store observations were made as detailed in Table 11.

Table 11: Assumptions made in Data used for Input in Toolkit to Estimate Mercury Releases for Lighting Products

| Toolkit Source Category for Lighting Products | Estimated Number of Items Sold in 2021 | Assumptions made |
|---|--|--|
| Fluorescent Tubes (double ended) | 17,581 | The number of private households in was estimated to be 17,581 (Ministry of Finance, 2014). Assuming a 98.2% electrification rate, it was estimated that the average household purchased 2 double-ended lighting devices per year and that at least 1 would be a mercury-added LFL. |

| Toolkit Source Category for Lighting Products | Estimated Number of Items Sold in 2021 | Assumptions made |
|--|--|---|
| Compact Fluorescent Lamp (CFL single end) | 35,162 | <p>The estimation that there were 17,581 private households was also applied to estimate the number of single-ended bulbs purchased in 2021.</p> <p>It was assumed that 4 single-ended bulbs were used in private households per year and that 2 would be mercury-added CFLs.</p> <p>This resulted in the assumption that (2 x 17,581) CFLs estimated were purchased in 2021.</p> |
| HIDLs (includes High pressure sodium lamps and Metal Halide Lamps) | 0 | Observations at Majuro retail stores found mainly LED alternatives and LED compliant lighting fixtures for these products as well as halogen varieties. The number of mercury added HIDLs was assumed to be negligible. |
| <p>Note: Overall assumption that observations made in the two (2) retail stores in Koror would be representative of the rest of the country. This estimation also did not take into account businesses or public institutions.</p> | | |

Table 12 summarises the mercury inputs and releases to Palau from the estimated number of mercury added lighting devices sold in 2021. The input factors and output distribution factors used to estimate mercury releases were obtained from the Toolkit.

Table 12: Analysis of mercury inputs and outputs from the use and disposal of lighting devices

| Use and Disposal of Lighting Devices | Unit | LFLs | CFLs |
|---|----------------|-------------|-------------|
| Activity rate | items/y | 17,581 | 35,162 |
| Input factor for phase | mg Hg/t | 8.00 | 2.70 |
| Calculated input to phase | Kg Hg/y | 0.14 | 0.09 |
| | | 0.24 | |
| Output distribution factors for phase (No separate collection; Waste Handling Controlled): | | | |
| - Air | N/A | 0.05 | |
| - Water | N/A | - | |
| - Land | N/A | - | |
| - Products | N/A | - | |
| - General waste treatment | N/A | 0.95 | |
| - Sector specific waste treatment | N/A | - | |
| Calculated outputs/releases to: | | | |
| - Air | Kg Hg/y | 0.01 | |
| - Water | Kg Hg/y | - | |
| - Land | Kg Hg/y | - | |
| - Products | Kg Hg/y | - | |
| - General waste treatment | Kg Hg/y | 0.23 | |
| - Sector specific waste treatment | Kg Hg/y | - | |

2.3.4 Use and Disposal of Batteries

Mercury has been used in various types of batteries such as primary, non-rechargeable batteries which contain mercury include mercury oxide batteries, some cylindrical alkaline batteries, and some button cell batteries (alkaline, zinc/air, silver oxide) over the years. Mercury concentrations have ranged greatly amongst different types of batteries from less than 1% wet weight (w/w) to 30-32% w/w. Once intact, mercury added batteries do not pose a threat to human health or the environment while in use but become a hazard when the batteries are damaged or disposed of.

As of 2019, global market data on mercury-added batteries found that many well-known global battery suppliers only supply mercury-free batteries. Furthermore, as of January 2021, China prohibited the manufacturing and import of mercury-added batteries except for the types still allowed under the Minamata Convention (UNEP, 2019b).

In Palau, batteries are imported for use in various equipment and applications. There is no separate collection of batteries for disposal.

Data Collection and Assessment

Data on the imports of mercury-added batteries over the past 5 years was unavailable at the time of the inventory. Site visits to local retail stores located in Koror were made to observe the types of batteries sold. Popular brands observed included:

- *Duracell*
- *Energizer*
- *Rayovac*
- *Kodak (had label stating '0% mercury')*

While Duracell, Energizer and Rayovac did not have labelling to confirm the absence or presence of mercury, further research indicated that all have stated that their batteries manufactured after 2019 are mercury-free.

As there is no separate collection of these types of batteries for end-of-life disposal, mercury releases to general waste are expected for mercury-added batteries imported, used and disposed of prior to the phase-out of mercury by the major manufacturing brands. Due to the lack of available data, mercury releases for batteries could not be quantified.

2.3.5 Use and Disposal of Cosmetics with mercury

For cosmetics, mercury has been used as a preservative in some cases over the years or may be present as an unintended contaminant. However, the most prevalent use of mercury in cosmetics globally has been its intentional use for the production of skin lightening products since mercury can inhibit the formation of melanin (the skin's dark brown or black pigment), thereby lightening the user's complexion (WHO, 2011). The mercury in these products can accumulate within the body where it can cause damage to the nervous system and have adverse effects on the kidney and other organs (UNEP, 2019a).

Data Collection and Assessment

While the use of skin-lightening products is not anticipated to be a prevalent issue in Palau and the wider Pacific region, an increase in the import of cosmetic products from Asia has been observed in recent years. Site visits to retail shops in Koror identified the presence of soaps labelled as “skin brightening” and “skin lightening”, mainly produced in the Philippines. The presence of mercury in these products is uncertain as typically many mercury-added skin lightening products are unlabelled or mislabelled. While the presence of mercury-added skin-lightening products could not be confirmed under this assessment, samples of products available in the Pacific were collected for testing by BRI as part of a global project, GEF 10810 “Eliminating Mercury Skin Lightening Products”. Findings and updates will be made available under the project’s knowledge hub available at: www.unep.org/mercuryfreecosmetics.

2.4 Data and Inventory on Other Intentional Product/Process Use

2.4.1 Dental mercury-amalgam Fillings

Dental amalgam, which is a mixture of metals including mercury, is used in dental restoration procedures to fill cavities (FDA, 2017). The amalgam can be supplied to dentists in the following forms:

- Pre-capsulated dental amalgam (silver amalgam) (single-dental restoration capsules of pre-dosed amalgam)
- Powdered mercury alloy or liquid elemental mercury (requires manually taking out needed amounts and mixing).

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

Under the Minamata Convention on Mercury, the manufacture, import and export of dental amalgam is not yet prohibited but a phase-down approach is outlined by which Parties should adopt at least two (2) of several suggested approaches for restricting use. Further to the recommended measures, as of 2022, Parties are obligated to, “exclude or not allow, by taking measures as appropriate, the use of mercury in bulk form by dental practitioners”. The use of pre-capsulated single-dose dental restoration capsules which have a lesser risk of mercury exposure is allowed.

As of 2022, Parties will also be expected to take appropriate measures to prevent dental amalgam use for patients under 15 years of age, and of pregnant and breastfeeding women, except when considered necessary.

Data Collection and Assessment

To gather information on the use of dental mercury amalgam fillings, a side meeting was held with a representative from the Oral Health Department of the Ministry of Health and Human Services. It was noted that for dental restoration material (fillings), pre-capsulated amalgam, composite and glass ionomer cement (GIC) are used in Palau. There are two (2) private dental clinics and one (1) public dental clinic in Palau.

It was noted that the pre-capsulated dental amalgam was used in approximately 10 – 20% of dental restoration procedures per year. In terms of disposal, reusable dental chair side trap screens are used, and residues are typically go to general wastewater or hospital waste disposal.

In order to estimate mercury releases from dental amalgam fillings, default calculations derived from the Toolkit were used to obtain an estimate of mercury input to society. These calculations utilized the number of dentists per 1,000 inhabitants (estimated to be 0.1111 for Palau according to the Toolkit) as well as the number of inhabitants.

Population data from 2021 was used to calculate the mercury input from the preparation of dental amalgam fillings at dental clinics in Palau. Mercury input and releases occurring from the use of amalgam fillings were expected to have been from amalgam placed 10 years prior in 2011 since mercury amalgam can last between 10-20 years before needing to be replaced. Mercury input from the disposal of dental amalgam was calculated using the country’s population from 20 years prior, 2001, due to the life expectancy of the fillings. Population data was sourced from the World Bank Database (2023).

According to the Toolkit, the overall input of mercury to society from the preparation, placement, use and disposal of dental amalgam over the years was calculated to be approximately 0.20 Kg Hg/y once double-counting assumptions were accounted for. The summary of estimated inputs and releases of mercury from dental amalgam is provided in Table 13.

Due to the gradual phasing out of mercury amalgam, estimated releases from this sector are expected to be reduced in further years.

Table 13: Analysis of mercury inputs and outputs from the preparation, use and disposal of dental amalgam in 2021.

| Dental Mercury-Amalgam Fillings | Unit | Preparation | Use | Disposal (In countries where only dental chair filters/strainers are used in most clinics) |
|---------------------------------|-------------------------------------|--|-------------|---|
| Activity rate | Inhabitants Dentists per 1000 | 18,174 | 17,748 | 19,390 |
| Input factor for phase | inhabitants g Hg/(y*inh) | 0.1111 | 0.1111 | 0.1111 |
| Calculated input to each phase | Kg Hg/y | 0.49 | 0.48 | 0.52 |
| Total input | Kg Hg/y | 0.51 <i>(once double-counting was factored in)</i> | | |

| Dental Mercury-Amalgam Fillings | Unit | Preparation | Use | Disposal (In countries where only dental chair filters/strainers are used in most clinics) |
|---|---------|-------------|------|---|
| Output distribution factors for phase: | | | | |
| - Air | N/A | 0.02 | - | - |
| - Water | N/A | 0.14 | 0.02 | 0.28 |
| - Land | N/A | - | - | 0.08 |
| - Products | N/A | - | - | 0.06 |
| - General waste treatment | N/A | 0.12 | - | 0.08 |
| - Sector specific waste treatment | N/A | 0.12 | - | 0.08 |
| Calculated outputs/releases to: | | | | |
| - Air | Kg Hg/y | 0.01 | - | - |
| - Water | Kg Hg/y | 0.07 | 0.01 | 0.15 |
| - Land | Kg Hg/y | - | - | 0.04 |
| - Products | Kg Hg/y | - | - | 0.03 |
| - General waste treatment | Kg Hg/y | 0.06 | - | 0.04 |
| - Sector specific waste treatment | Kg Hg/y | 0.06 | - | 0.04 |

2.4.2 Use and Disposal of Manometer and Gauges

Mercury has been used in some manometers, gauges, pressure valves and other measuring devices (UNEP, 2019a) historically, as it has a non-evaporating quality under normal conditions and its high and stable density (National Programme on Technology Enhanced Learning (NPTEL), n.d.). Globally, mercury containing equipment have become less common as mercury-free alternatives are readily available.

Data Collection and Assessment

Specific data on the number of medical blood pressure gauges imported and used in Palau in 2021 was not obtained for this inventory due to difficulties in differentiating mercury-containing from mercury-free blood pressure gauges. In order to estimate mercury releases from other manometers used in industry and equipment, default calculations for mercury input from the use and disposal of other manometers were used. 2021 population data and electricity rates were used in The Toolkit. It was also noted that no separate collection of manometers and gauges occurs within a controlled waste handling system.

The total input from the use and disposal of other manometers (not including medical devices) in 2021 was estimated to be 0.09 Kg Hg/y. A summary of estimated mercury releases from manometers and gauges is shown in Table 14.

Table 14: Analysis of mercury inputs and outputs from the use and disposal of manometers and gauges with mercury

| Manometers and Gauges with Mercury | Unit | Use and Disposal of Other Manometers |
|---|--|--------------------------------------|
| Activity rate | inhabitants | 18,174 |
| Input factor for phase | Percent of population with access to electricity | 98.2 |
| | g Hg/y*inhabitant | 0.005 |
| 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 | - | - |

2.5 Data and Inventory on Waste Incineration

2.5.1 Incineration of Medical Waste

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

Mercury may be released from incinerated medical products that may include medical thermometers, blood pressure gauges, dental amalgam fillings and mercury containing chemicals; it may also be released from human secretions.

Data Collection and Assessment

While a medical waste incinerator has been noted as present in Palau, data received indicated that it is not currently operational. Previous reports indicated that a medical waste incinerator was donated to the Belau National Hospital in the early 1990s but due to the lack of pollution control systems and complaints of smoke emissions by nearby residents, operation ceased, and medical waste has since been transported to the landfill for disposal (ENVIRON Australia Pty Ltd, 2014). If a new medical waste incinerator becomes operational, managing emissions for hazardous chemicals including mercury should be considered.

2.5.3 Open Waste Burning on Landfills and Informally

Informal/open waste burning refers to waste incineration undertaken in informal conditions such as in barrels, containers, or on bare land without emission controls (UNEP, 2019a). Mercury present in waste is released to air and incineration residue which may pollute the air, land, groundwater and surface waters (UNEP, 2019a).

Data Collection and Assessment

Informal burning of waste may occur throughout community areas in Palau, mainly by individuals. While no quantities of waste burnt have been recorded for the inventory development, it has been noted that mainly small amounts of green waste are burnt which may have trace amounts of mercury present that can be released to the air but in quantities that are assumed to be negligible.

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

2.6.1 Controlled Landfills

Controlled landfills refer to specially designated areas for waste deposition which are specially designed to prevent or reduce releases and emissions of waste components to the environment. Different types of designs for controlled landfills exist ranging from areas lined with impermeable materials such as clay or the development of leachate ponds to isolate liquid run-off to more technical engineering designs. Wastes deposited in landfills with efficient built-in measures are more effective at preventing contamination of surrounding areas with hazardous waste components including mercury (UNEP, 2019a).

Mercury in municipal waste varies typically depending on the amount of discarded, damaged or broken MAPs disposed of in the landfills (UNEP, 2019a). Mercury contained within MAPs may evaporate resulting in air emissions and small amounts of mercury may leach into waterways.

Data Collection and Assessment

Across the eleven (11) states of Palau, waste disposal methods varied prior to the year 2020 from open community dumpsites to controlled landfills (APWC, 2020). In Koror, where approximately 70% of the population reside, a new national landfill located in Aimeliik, became operational in 2021. With the opening of this landfill, it is expected that most, if not all, community dumpsites would be closed, and waste diverted to the new landfill which is engineered using the “Fukuoka” method. This method includes the implementation of semi-aerobic waste disposal technology by which bacteria is used to decompose the waste, contain its odour, and reduce its volume. A leachate pond also recycles water into the system. The old landfill site in Koror, known as M-dock, has been repurposed for mainly recycling activities.

For the purpose of the inventory, waste estimates were obtained from the Palau Waste Audit Report (APWC, 2020) which estimated the amount of waste collected daily across all eleven (11) states of Palau by extrapolating 2015 data. It was assumed that this estimation would be

the same in 2021. Therefore, in total, it was estimated that 12,496.14 t of waste are deposited at the dump sites/landfills in Palau per year.

Mercury-added product waste is not separated from general waste which is typically disposed of at public landfill/waste disposal sites across Palau. Table 15 provides a summary of the estimated mercury releases from controlled landfills/deposits for Palau. When calculations were adjusted to account for double-counting of mercury inputs due to other categories, it was determined that total releases to the environment was 0.12 Kg Hg/y released to air.

Table 15: Analysis of mercury inputs and outputs from controlled landfills/ deposits

| Controlled Landfills/ Deposits | Unit | Controlled Landfills |
|---|-----------------------|----------------------|
| Activity rate | Waste landfilled, t/y | 12,496.14 |
| Input factor for phase | g Hg/t waste | 1 |
| Calculated input to phase | Kg Hg/y | 12.50 |
| Output distribution factors for phase: | | |
| - Air | N/A | 0.01 |
| - Water | N/A | 0.0001 |
| - Land | - | - |
| - Products | - | - |
| - General waste treatment | - | - |
| - Sector specific waste treatment | - | - |
| Calculated outputs/releases to: | | |
| - Air | Kg Hg/y | 0.12 |
| - Water | Kg Hg/y | 0.00 |
| - Land | - | - |
| - Products | - | - |
| - General waste treatment | - | - |
| - Sector specific waste treatment | - | - |

2.6.2 Informal Dumping of General Waste

Informal dumping refers to the disposal of general waste in areas that are not specifically designated for waste and are without any safeguards to prevent the release of pollutants into the environment (UNEP, 2019a). Waste may consist of residential, green and construction waste which may have trace amounts of mercury present in materials or through the disposal of MAPs.

Data Collection and Assessment

Informal dumping of waste has been noted to take place in community areas in Palau. The volumes of waste dumped was not available for entry in the Toolkit. Based on population size, it was assumed that volumes of waste informally dumped would be negligible in terms of potential mercury releases.

2.6.3 Wastewater System/Treatment

Wastewater systems or treatment process are considered to be an intermediate mercury release pathways for mercury that may have originated from MAPs such as dental amalgam that may have been entered waterways through preparation or disposal or from other MAPs such as

broken thermometers and other devices or industrial discharges. Atmospheric mercury, originating from both natural and anthropogenic sources may also enter wastewater when washed out by precipitation which makes its way into soil, surface and ground water (UNEP, 2019a).

Depending on the type of wastewater treatment, mercury content and distribution will vary as it may be released into waterways after treatment, distributed through sludge as fertiliser on land or as waste deposited at a landfill (UNEP, 2019a).

Data Collection and Assessment

For data collection on wastewater systems, a questionnaire survey response was received from Palau Public Utilities Corporation Wastewater Operations. It was noted that there are two (2) main wastewater treatment plants in Palau, Koror Sewer Treatment Plant and Melekeok Sewer Treatment Plant. The main form of wastewater treatment was indicated to be a mixture of mechanical and some biological (activated sludge) treatment (with no land application of sludge).

The design capacity of the Koror Sewer Treatment Plant was noted to be 9,540 cubic meters while the smaller Melekeok Sewer Treatment Plant has a capacity for 275 m³ per day. The estimated daily treatment of each plant was provided in order to extrapolate the estimated yearly output for entry in the Toolkit.

Results are shown in Table 16 below.

Table 16: Analysis of mercury inputs and outputs from wastewater treatment

| Wastewater | Unit | Wastewater |
|---|----------------------------------|-------------|
| Activity rate | Waste water, m ³ /y | 1,883,400 |
| Input factor for phase | mg Hg/m ³ waste water | 5.25 |
| Calculated input to phase | Kg Hg/y | 9.89 |
| Output distribution factors for phase: | | |
| - Air | - | - |
| - Water | N/A | 0.50 |
| - Land | - | - |
| - Products | - | - |
| - General waste treatment | N/A | 0.30 |
| - Sector specific waste treatment | N/A | 0.20 |
| Calculated outputs/releases to: | | |
| - Air | - | - |
| - Water | Kg Hg/y | 4.94 |
| - Land | - | - |
| - Products | - | - |
| - General waste treatment | Kg Hg/y | 2.97 |
| - Sector specific waste treatment | Kg Hg/y | 1.98 |

2.7 Data and Inventory on Crematoria and Cemeteries

Mercury can accumulate in humans through the use of dental amalgam, exposure to mercury contained in products and intentionally used in processes, and consumption of mercury

contaminated aquatic species. This mercury may be released after death when a corpse is cremated or buried.

2.7.1 Cemeteries

During decomposition, mercury in human corpses can be released into the soil in cemeteries. Mercury in corpses were typically estimated to be due to dental amalgam releases.

Data Collection and Assessment

Across Palau, cemeteries are located typically within communities. The number of deaths estimated in 2021 was used for entry in the Toolkit, as it was the most available year available via: [The Total Deaths in Republic of Palau \(2018 - 2026, People\) - GlobalData](#). Estimated mercury releases from burials are shown in Table 17.

Table 17: Analysis of mercury inputs and outputs from cemeteries

| Cemeteries | Unit | Cemeteries |
|---|---------------------------------------|-------------|
| Activity rate | Corpses buried/y | 149 |
| Input factor for phase | g Hg/corpse | 4 |
| Adjustment for dental personnel density as dental amalgam is the major contributor to mercury in the human body | Dentist per 1000 inhabitants, country | 0.1111 |
| Calculated input to phase | Kg Hg/y | 0.08 |
| Output distribution factors for phase: | | |
| - Air | - | - |
| - Water | - | - |
| - Land | N/A | 1 |
| - Products | - | - |
| - General waste treatment | - | - |
| - Sector specific waste treatment | - | - |
| Calculated outputs/releases to: | | |
| - Air | - | - |
| - Water | - | - |
| - Land | Kg Hg/y | 0.08 |
| - Products | - | - |
| - General waste treatment | - | - |
| - Sector specific waste treatment | - | - |

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

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

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

Palau does not currently have any notable stocks of mercury and/or mercury compounds as no significant activities occur that would require such stocks.

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

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

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

2.10 Identification of Hot Spots of Mercury Contamination (Contaminated Sites)

Article 12 of the Minamata Convention on Mercury states that Parties should “develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds”. Risk reduction activities should be conducted using environmentally sound measures and should incorporate an assessment of the risks to human and environmental health from present mercury or mercury compounds. Hot spots of mercury contamination exist as the direct result of the use and release of mercury in processes leading to on-site deposition, as well as the inadequate disposal of mercury-contaminated materials. Previous deposits of mercury may still have the potential to release significant amounts of mercury and pose a risk to human health and the environment. Potential hot spots may include reservoirs where mercury containing materials have been stored, dumped or accumulated over many years.

Table 18 indicates potential sites that may be sources of mercury contamination. Figure 10 shows a map of Koror and Badeldaob, Palau where tracking of the locations of potentially mercury contaminated sites was initiated. Further geospatial data on the other islands of Palau is recommended to provide a clearer indication of potential sites of interest for the country as a whole.

Table 18: Potentially contaminated sites for further analysis.

| Potentially Contaminated Site | Description |
|-------------------------------|--|
| Landfills | Palau has a landfill in Koror known as ‘M-dock’ located near shallow reef and mangrove ecosystems operating as an open dumpsite until 2006-2007, when it was rehabilitated. It reached full capacity in 2012. A new national engineered landfill has been established in Aimeliik, Babeldaob. |
| Hospital | Medical waste generated at hospitals is potentially contaminated with mercury. On-site waste storage areas and wastewater may be sources of mercury contamination. |

| | |
|---------------------------|--|
| Medical Waste Incinerator | Medical waste generated at hospitals is potentially contaminated with mercury. When disposed of or incinerated, mercury contained within equipment or dental amalgam, may be released to the environment. In Palau, the medical waste incinerator is not currently in use and medical waste is currently disposed of at the landfill. |
| Sewage outflow | Wastewater can contain mercury waste from a variety of sources, including intentional use in products or processes. Wastewater can contain mercury waste from a variety of sources, including intentional use in products or processes. There are 2 main wastewater treatment plants in Palau- Koror Sewer Treatment Plant and Melekeok Sewer Treatment Plant. |
| Power plant and fuels | Fossil fuels naturally have small amounts of mercury that can be released during incineration or accumulate slowly through time. In Palau, the operational power plant is mainly powered by diesel. |

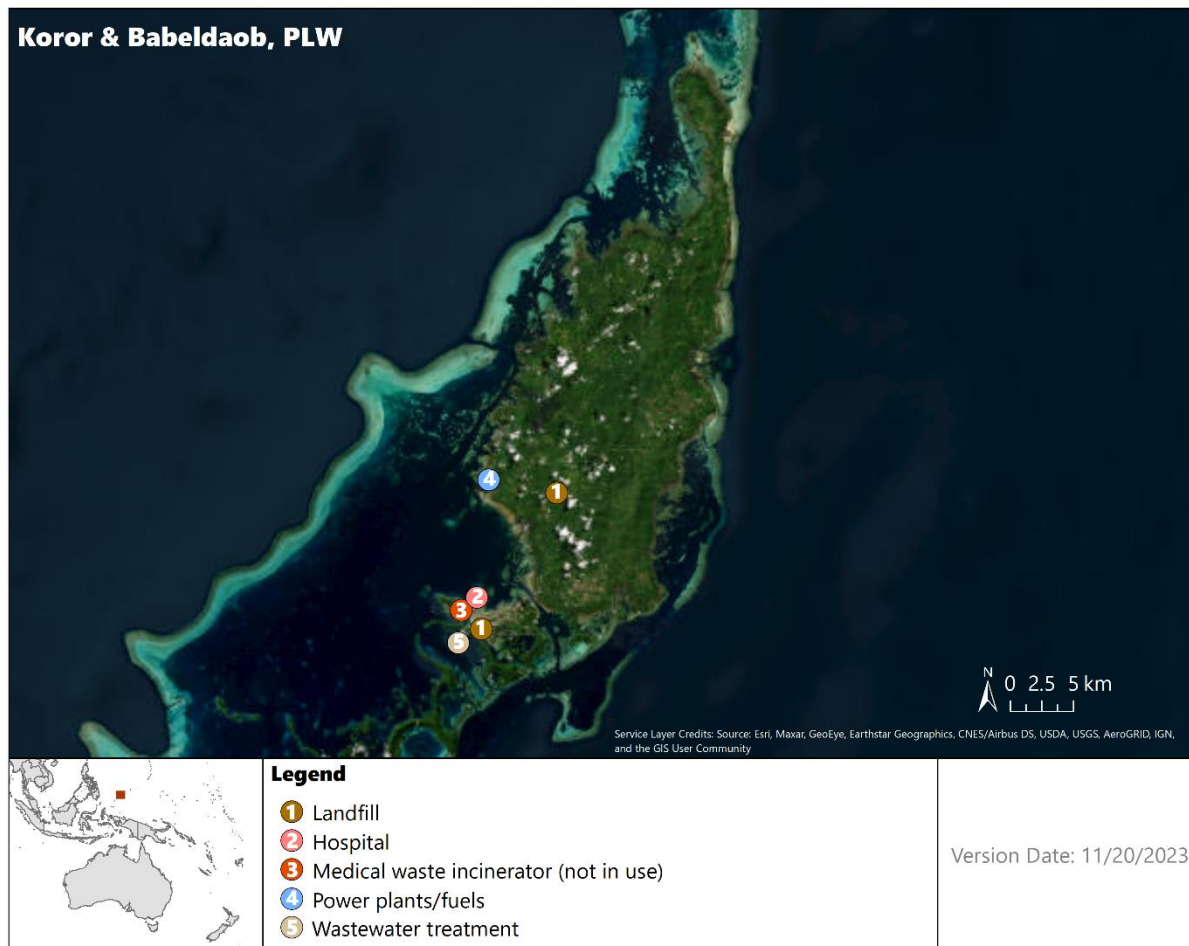


Figure 10: Map indicating potentially mercury contaminated sites in Koror and Babeldaob, Palau.

Mercury inputs to the environment do not always directly correlate with mercury levels in biota and humans. Once in the environment, mercury can be converted into its more toxic and bioavailable form, methylmercury, by communities of iron- and sulphur- reducing bacteria. Methylmercury can bioaccumulate in individual organisms through time and biomagnify up

trophic levels. A suite of factors impacts the potential of a particular system to methylate mercury depending on how favorable conditions are for the bacterial communities to methylate mercury.

For example, the wet-dry cycle associated with wetlands and mangroves or the ability of forest canopies to scavenge mercury from the air make them ecosystems particularly sensitive to mercury inputs. Sensitive systems may exhibit high concentration and effects of mercury in biota despite low to moderate mercury inputs, while conversely, areas with low methylation potential may exhibit little mercury impact despite high inputs. As a result, it is important to understand the spatial context of potentially mercury contaminated sites to inform the threat from mercury contamination in the environment.

Further research on the spatial distribution of potentially contaminated sites in relation to ecosystem characteristics that increase the methylation potential of mercury inputs should be conducted to inform locations prioritized for further study on the threat from mercury on human health and the environment and for future use in evaluating the effectiveness of the Minamata Convention. Additionally, these – and any additional – potentially contaminated sites should be verified by the relevant national authorities.

[2.11 Impact of Mercury on Human Health and the Environment³](#)

Elemental mercury, which is found in manufactured products, is not necessarily toxic to humans. Exceptions may include dental amalgam and cosmetics, but these products are still under scientific investigation, so their potential harm is not yet fully characterized.

Methylmercury, the organic form of mercury, is toxic to humans because it can biomagnify in food webs and bioaccumulate over time in organisms. A neurotoxin, methylmercury can cause physiological harm and behavioral disorders in people. Fish from the sea or freshwater systems can be a major source of methylmercury. In general, fish species that are small, short-lived, and forage low in the food web contain less methylmercury, while predatory species that are long-lived and grow larger can contain higher levels of methylmercury. Many of the fish available in the Pacific are safe to eat, although more information is needed about the mercury concentrations to better characterize how mercury is distributed in different species of fish in the waterscape of Pacific nations.

Studies have shown that high mercury concentrations in fish (measured in methylmercury) can have negative impacts on fish growth, behavior, and reproduction. Consequently, fish-eating wildlife are shown to have decreased reproductive success when methylmercury concentrations in fish are high. As a neurotoxin, methylmercury can also have negative effects on behavior such as foraging or nest protection. The process of methylation, the conversion of elemental mercury to organic methylmercury, varies widely on the landscape and within the waterscape.

Areas that are particularly sensitive to mercury deposition—where methylation rates are highest and biomagnification in the food web is greatest, and where animals experience

³ Section contains extracts from “State of Mercury in the Pacific Region” (BRI, 2023).

significant reproductive harm—are called biological mercury hotspots. These areas generally represent aquatic ecosystems or have an aquatic connection within the food web.

Aquatic ecosystems, either marine (e.g., beaches and coral reefs) or freshwater (e.g., lakes and rivers), are often prime areas for high methylation rates. Fish and wildlife predators that live in rivers and lakes, or that forage in a food web associated with these habitats (e.g., mangroves), often contain elevated mercury levels. The combination of high methylation rates and longer-lived animals higher in the food web creates the greatest risk of adverse effects.

Habitats at the greatest risk of mercury methylation include wetlands, mangroves and aquatic habitats near contaminated sites (such as landfills). Wildlife at greatest risk of mercury contamination (besides fish species) include Albatrosses, Cormorants, Frigatebirds, Petrels, Shearwaters and Tern.

BRI, in collaboration with other entities under the Minamata Convention on Mercury, is working on several fronts to conduct and promote mercury biomonitoring across the globe. Biomonitoring is the process of assessing the health of organisms and ecosystems and tracking changes in mercury risk and exposure over time. Monitoring mercury exposure to humans will help the global community to meet the requirements of the Minamata Convention on Mercury and will also help identify global biological hotspots that represent elevated levels of mercury exposure that may pose serious threats to both ecosystem and human health.

In Palau, coordination amongst BRI, EQPB and the Bureau of Fisheries, Ministry of Agriculture Fisheries and the Environment is ongoing to conduct a rapid mercury analysis of potential fish species of interest.

Chapter 3 Policy, Regulatory and Institutional Framework Assessment

3.1 Regulatory Obligations Under the Minamata Convention on Mercury

The Minamata Convention on Mercury consists of 35 Articles with 5 supporting Annexes.

General areas of focus include control measures for mercury management, support mechanisms in place for Parties and administrative notes that refer to the functioning of the Minamata Convention itself.

Articles 1 and 2 state the overall objective of the Minamata Convention and relevant definitions outlined in its text. Table 19 provides an overall summary of the Articles of the Convention that are related to Party obligations and indicate their relevance to Palau for further discussion in this Chapter.

Table 19: Summary of the Articles of the Minamata Convention on Mercury in relation to their Relevance to Palau

| Article | Brief Description of Article | Relevance to Palau |
|---|--|---|
| <u>Article 3</u> <u>Mercury Supply,</u> <u>Source and</u> <u>Trade</u> | Parties are obligated to control primary mercury mining activities and individual stocks of mercury or mercury compounds exceeding 50 metric tons, as well as sources of mercury supply generating stocks exceeding 10 metric tons per year within a territory. | Not relevant to Palau as no primary mercury mining occurs and no stocks of relevant quantities exist as stated. |
| <u>Article 4</u> <u>Mercury-added</u> <u>products</u> | Parties are obligated to phase-out the manufacture, import and export of certain mercury-added products listed in Annex A Part I of the Convention. Under Annex A Part II, phase-down obligations for dental amalgam fillings are detailed. Following the COP-4 outcomes, further obligations for Annex A have been implemented. | While Palau does not manufacture or export mercury-added products, imports of certain MAPs are detailed in Chapter 2 of this report that must be phased out or phased down according to the Convention's obligations. |
| <u>Article 5</u> <u>Manufacturing</u> <u>processes in</u> <u>which mercury</u> <u>or</u> <u>mercury</u> <u>compounds are</u> <u>used</u> | Parties must phase out the use of mercury or mercury compounds in manufacturing processes described in Annex B of the Convention. | Not relevant to Palau as the related manufacturing processes do not take place. |
| <u>Article 7</u> <u>Artisanal and</u> <u>small-scale gold</u> <u>mining</u> | Parties must control the use of mercury and mercury compounds in artisanal and small-scale gold mining activities. | Not relevant to Palau as the related activities do not take place. |
| <u>Article 8</u> <u>Emissions</u> | Parties must control and, where feasible, reduce emissions of mercury and mercury compounds to the atmosphere (air) through measures to control | In Palau, as identified in Section 2.5 of this report, a medical waste incinerator is present, though not currently operational. "Waste |

| Article | Brief Description of Article | Relevance to Palau |
|--|---|--|
| | emissions from the point sources listed in Annex D of the Convention. | incineration facilities” are included in Annex D for management. |
| <u>Article 9</u> <u>Releases</u> | Aims to control and, where feasible, reduce releases of mercury and mercury compounds to the land and water from relevant point sources determined in the Party’s national inventory. | Sources of mercury releases to land and water have been identified in Chapter 2 of this report for management. |
| <u>Article 10</u> <u>Environmentally sound interim storage of mercury, other than waste mercury</u> | Aims to implement measures for environmentally sound interim storage of mercury and mercury compounds in relation to Article 3. | Not relevant as the related Article 3 is not relevant to Palau. |
| <u>Article 11</u> <u>Mercury wastes</u> | Outlines obligations for the environmentally sound management, transport, storage and disposal of mercury wastes as defined under the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal. | Potential generation of mercury waste sources have been identified in Chapter 2 for management. Palau is also a Party to the Basel Convention. |
| <u>Article 12</u> <u>Contaminated sites</u> | Encourages Parties to endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds. A guidance document ⁴ on the management of contaminated sites was adopted by the Conference of the Parties of the Minamata Convention on Mercury to support countries. | Under Section 2.10 of this report, a strategy for the identification of potential mercury hotspots was developed. This can be used to further guide the Government of Palau in the identification of mercury-contaminated sites and the development of measures to address them. |
| <u>Article 16</u> <u>Health Aspects</u> | Encourages Parties to promote the development and implementation of various tools and techniques to identify and protect populations at risk, particularly vulnerable populations, of mercury exposure. | Education and awareness strategies should be developed and can be guided through the findings of the MIA and through related GEF ISLANDS Project activities to be implemented. |
| Articles of the Minamata Convention on Mercury related to Support Mechanisms for Implementation (may be briefly referenced in this Chapter) | | |
| Article | Brief Description of Article | Relevance to RMI |
| <u>Article 13</u> <u>Financial resources and mechanisms</u> | Aims to support small island developing states (SIDS) in the implementation of the Convention through an established financial mechanism. | As a SIDS, Palau can access financial resources and capacity-building assistance for the implementation of the Convention. The MIA Project was enabled under this Article as well as the GEF ISLANDS Project. |
| <u>Article 14</u> <u>Capacity-building, technical</u> | Encourages Parties to provide appropriate capacity-building and technical assistance to developing | Palau can access available assistance from Parties. Currently, through the MIA Project and GEF ISLANDS Project, Palau can |

⁴ Available at: [Guidance Contaminated Sites EN.pdf \(mercuryconvention.org\)](https://www.mercuryconvention.org/en/implementation-and-compliance/guidance-and-support/guidance-contaminated-sites-en.pdf)

| Article | Brief Description of Article | Relevance to Palau |
|---|--|---|
| <u>assistance and technology transfer</u> | country Parties for the implementation of the Convention's obligations. | benefit from the lessons learned sharing amongst participating countries. |
| <u>Article 17 Information exchange</u> | States that Parties should facilitate the sharing of relevant scientific, technical, economic and legal mercury information developed. This can be done through the Secretariat of the Minamata Convention or other relevant organisations. | The MIA Report and findings conducted under this MIA Project will be shared with the Secretariat of the Minamata Convention, Global Mercury Partnership and other relevant organisations as needed. |
| <u>Article 18 Public information, education and awareness</u> | Notes that each Party should promote and facilitate the sharing of available information on mercury to the public. The facilitation of education, training and public awareness related to the health and environmental effects of exposure to mercury should be done with relevant intergovernmental and non-governmental organisations as appropriate. | This may be done under the guidance of the EQPB and facilitated through the findings of the MIA and GEF ISLANDS. |
| <u>Article 19 Research, development and monitoring</u> | Notes that Parties shall endeavour to develop and improve upon various mercury monitoring and research activities. | Under the MIA Project, Palau has developed an inventory of mercury releases, developed strategies for potential mercury hotspot mapping, initiated mercury biomonitoring among other activities to promote research, development and monitoring. |
| <u>Article 20 Implementation Plans</u> | Details that following the MIA activities, each Party may develop and execute an implementation plan to meet their obligations to the Minamata Convention. | Chapter 6 of this MIA Report provides considerations that Palau can take into account for the development of an implementation plan which should be developed further in consultation with national stakeholders. Additional guidance ⁵ on the development of an implementation plan is provided on the Minamata Convention's website. |
| <u>Article 21 Reporting</u> | States that each Party shall report on the measures taken to implement the Convention and note the effectiveness of measures and possible challenges. | The national focal point must submit report to the Secretariat of the Minamata Convention in coordination with relevant stakeholders. An online reporting tool has been made available to Parties. |
| NOTE: Other Articles not included in this table generally refer to the functioning of the Minamata Convention itself and will not be discussed in detail in this report. | | |

⁵ [Forms and guidance documents | Minamata Convention on Mercury \(mercuryconvention.org\)](https://www.mercuryconvention.org/)

3.2 Assessment of Relevant Policies and Legislation in Palau

A summary of some of the relevant national policies and legislation relevant to the key obligations of the Minamata Convention on Mercury is provided as follows:

Legislation and Regulations:

National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act establishes the EQPB and its duties which include, the establishment and provision for the, “continuing administration of a permit system, whereby a permit shall be required for the discharge by any person of any pollutant in the air, land, or water, or for the conduct by any person of any activity, including, but not limited to, the operation, construction, expansion or alteration of any installation which results in or may result in the discharge of any pollutant in the air, land or water...” and the promulgation and enforcement of hazardous waste regulations.

Under this Act, several regulations of relevance have been established:

- **Air Pollution Control Regulations (Chapter 2401-71)**- gives authority to the EQPB to enforce control of the discharge of pollutants to air. Emission standards for mercury air pollution are set according to the US Environmental Protection Agency (US EPA). Regulations on National Emission Standards for Hazardous Air Pollutants (40 CFR, Part 61) designated in Section 2401-71-62, Subpart E. It is however important to note that these standards under Subpart E refer to mercury emissions from activities such as mercury ore processing facilities, sludge incineration plants, and other industrial activities that are not relevant to Palau. For waste incinerators, standards exist for particulate matter but not mercury. Under the regulations, open burning by persons in Palau is prohibited unless otherwise specified.
- **Solid Waste Management Regulations (Chapter 2401-31)**- gives authority to the EQPB to establish minimum standards for the infrastructure and maintenance of solid waste management systems in Palau that are intended to prevent pollution of drinking and recreational waters, air and land. The protection of public health safety, conservation of natural resources and preservation and enhancement of the beauty and quality of the environment are also goal of the standards established. General standards for hazardous waste disposal and incineration are also outlined.
- **Marine and Freshwater Quality Regulations (Chapter 2401-11)**- gives authority to the EQPB to enforce regulations for the protection of various waters in Palau and to specify water quality standards to maintain desired uses. Under these regulations, it is specifically stated that, “in addition to the methyl mercury criteria for human health from the EPA 2002 publication, the water column concentration of mercury shall not exceed 0.05 µg/L”.
- **Wastewater Treatment and Disposal Regulations (Chapter 2401-13)**- gives authority to the EQPB to enforce regulations on wastewater treatment and disposal systems. Establishing minimum standards for the infrastructure and functioning of

wastewater treatment and discharge systems to prevent contamination of the environment are also outlined. For “Electrical/Mechanical/Chemical Wastewater Treatment Systems with Point Effluent Discharge”, it is noted that chemical or biological analyses for wastewater parameters, “shall be included for influent and effluent for all proposed electrical/mechanical/chemical treatment works, to characterize the waste stream and demonstrate removal efficiencies, including... Priority Pollutant Scan per US EPA Priority Pollutant List (40 CFR Part 423, Appendix A)”. Mercury is included in this US EPA list. It is also noted that, “Wastewater treatment systems utilizing electrical/mechanical/chemical processes shall be designed and operated to produce, at a minimum, a secondary treated effluent and control of priority pollutants”.

- **Ozone Layer Protection Regulations (Chapter 2401-81)**- governs the import, export, sale and manufacture of ozone depleting substances within Palau.
- **Pesticides Regulations (Chapter 2401-33)**- aims to maintain and establish control of imports, distribution, sale and use of pesticides nationally through the enforcement of regulations by the EQPB.

The Customs Regulations, 2006 (under National Code- Title 40: Revenue and Taxation: Division 2: Unified Tax Act) establish the rules and procedures for the import and export of items at ports of entry and exit and give authority to:

- the Minister of Finance (to provide legislative and policy support),
- the Director of the Bureau of Revenue, Customs and Taxation (to provide necessary guidance and assistance to the Chief of the Division of Customs and to the Minister of Finance on legislative and policy matters as needed),
- The Chief of the Division of Customs (to directly supervise Customs Officers) and,
- The duly appointed Customs Officers (to carry out their assigned duties).

Under Section 4.5, the prohibition of importation of goods that are, “prohibited or restricted by law or regulation will be considered as contraband and seized by Customs.”

The **National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health** establishes the duties of the Director of the Bureau of Public Health to maintain and improve health and sanitary conditions, establish standards of medical and dental care and practice and encourage health-related scientific investigation, among other duties. The Director, under the approval of the President, has the authority to make regulations for public health and safety related to areas including but not limited to, burial grounds, public or private hospitals, laboratories and the manufacture/preparation/sale of cosmetics.

Under the National Code- Title 34, the **Environmental Health Regulations, 2004** were developed which authorises the Ministry of Health to regulate activities for the disposal of related waste through methods that may include incineration. Under Article 24 of the regulations, the EQPB regulations for air pollution and hazardous materials were adopted.

The **National Code- Title 27: Fishing- Chapter 1: Fishery Zones and Regulation for Foreign Fishing, Sub-Chapter II Ministry of Natural Resources, Environment and**

Tourism, outlines the fisheries-related duties of the Ministry which includes the adoption of regulations for the conservation, management and exploitation of all living resources in the surrounding waters of Palau.

Related Policies, Plans and Projects to Enhance National Regulatory Framework:

1. The **National Solid Waste Management Strategy: The Roadmap towards a Clean and Safe Palau 2017 to 2026** was developed to outline the actions needed for policy makers and programme implementers to make more informed decisions to manage changing and emerging issues for solid waste management. Mercury waste is not specifically mentioned but falls under the broad category of hazardous wastes and the actions outlined to encourage the selection of appropriate and affordable technology in overall waste management strategies that prioritise, “public health and environmental protection, sustainability and compliance with international and regional treaties...”.
2. **Palau National Plan for Implementation of the Stockholm Convention on Persistent Organic Pollutants 2013** is an implementation plan for Palau to meet its Party obligations under the Stockholm Convention.
3. Palau is a participating country in the Pacific region’s project under the GEF-funded global programme **Implementing Sustainable Low and Non-Chemicals Development in Small Island Developing States (GEF ISLANDS)** which aims to strengthen countries’ abilities to control the flow of chemicals, products and materials into their territories and to unlock resources for long term management of chemicals and wastes including integrated chemicals and wastes management in SIDS.
4. Palau is a participating country in the **‘Improving Pacific Islands Customs and Trade’ (IMPACT) Project** funded by the European Union. Under this project, the United Nations Conference on Trade and Development (UNCTAD) in coordination with the Oceania Customs Organisation (OCO) will work with project countries to improve trade facilitation and harmonise customs operations through the review or drafting of Customs legislation and training in use of the global ASYCUDA (Automated System for Customs Data).
5. The **Palau Climate Change Policy 2015** outlines priorities to adapt effectively to climate change issues. This includes general measures to protect the environment through the reduction of hazardous waste streams.
6. **‘Zero Disposable Plastic’ Policy, Executive Order No. 417** is an executive order by the President that established an immediate ban on provision of certain disposable plastic containers by all government offices and agencies to employees and guests.

Table 20 provides a summary of the national policies, legislation and regulations relevant to the key obligations of the Minamata Convention on Mercury as outlined in Section 3.1 of this report.

Table 20: Assessment of Existing Legislation Relevant to Mercury Control Measures in Palau

| Provision of the Minamata Convention | Relevant Act, legislation and regulation | Policy and Legislative Gap Analysis (if present) | Proposed Legal Reform Action (if needed) |
|---|---|--|---|
| <p>Overarching Minamata Convention on Mercury (including: Article 13 Financial Resources and Mechanisms; Article 14 Capacity-building, technical assistance and technology transfer; Article 17 Information Exchange; Article 18 Public information, education and awareness; Article 20 Implementation Plans; Article 21 Reporting)</p> | <p>National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act</p> <p>‘Zero Disposable Plastic’ Policy, Executive Order No. 417</p> <p>Palau National Plan for Implementation of the Stockholm Convention on Persistent Organic Pollutants 2013</p> | <p>No formal mechanism is in place for the implementation of the Minamata Convention on Mercury.</p> | <p>Similar to regulations developed under the Environmental Quality Protection Act such as the Ozone Layer Protection Regulations (Chapter 2401-81), a regulation should be developed to provide for the implementation of obligations of the Minamata Convention on Mercury.</p> <p>Another action that can be taken if agreed is the development of an executive order by the President to implement the phase out of mercury according to Minamata Convention on Mercury, similar to the ‘Zero Disposable Plastic’ Policy, Executive Order No. 417.</p> <p>The proposed policy or regulation for the Minamata Convention should not only include measures to facilitate the monitoring of mercury releases from sources and prohibition of imports of mercury, mercury compounds and mercury added products, but should also formally recognise the focal point or delegated authority’s responsibility for implementing other administrative measures such as the facilitation of information exchange and reporting requirements. This can be further reflected in updated environmental and strategic national plans, along with other relevant environmental agreements.</p> <p>The development of an implementation plan for the Minamata Convention is optional under Article 20. Reference can be made to the National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants 2008 if an implementation plan is to be developed.</p> |

| Provision of the Minamata Convention | Relevant Act, legislation and regulation | Policy and Legislative Gap Analysis (if present) | Proposed Legal Reform Action (if needed) |
|--|--|--|---|
| | | | Note: Under the GEF ISLANDS regional project and global programme, funding under Article 13 is provided to facilitate national capacity building, information exchange and awareness raising activities for mercury issues). |
| <u>Article 4: Mercury-added Products</u> | <p>Customs Regulations, 2006</p> <p>National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act:</p> <ul style="list-style-type: none"> • Ozone Layer Protection Regulations, Chapter 2401-81 • Pesticide Regulations, Chapter 2401-33 <p>National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health</p> | As of 2023, a bill was proposed to modernize customs control and enforcement through the development of a consolidated Act. | <p>The development of a regulation under the Environmental Quality Protection Act (similar to the Ozone Layer Protection Regulations or Pesticide Regulations, Chapter 2401-33 EQPB Regulations), should be established for mercury that prevents the import of mercury, mercury compounds and mercury added products as listed under Article 4, Annex A Part I of the Minamata Convention on Mercury.</p> <p>Through the IMPACT project, revision or drafting of Customs legislation should further enable the regulatory mechanism to prohibit the importation of mercury, mercury compounds and mercury added products.</p> <p>Regarding phase down requirements for dental amalgam under Article 4, Annex A Part II, The Director of the Bureau of Public Health has the power to coordinate with and advise the national dental sector on such measures under National Code- Title 34.</p> |
| <u>Articles 8: Emissions, Article 9: Releases, Article 11: Mercury Wastes</u> | <p>National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act:</p> <ul style="list-style-type: none"> • Air Pollution Control Regulations (Chapter 2401-71) • Solid Waste Management | <p>For management of mercury releases from the medical sector (including medical waste disposal methods like incineration), the Environmental Health Regulations adopts the EQPB regulations for air pollution and hazardous materials.</p> <p>While the Air Pollution Control Regulations include emission standards for mercury, these</p> | <p>It is noted that mercury thresholds for wastewater systems, marine and freshwater sources are already adequately addressed.</p> <p>The development of standards for mercury air emissions from waste incinerators which have been identified as present in Palau, should be addressed either by amendments to the existing air pollution regulations or through the development of a regulation specific to the management of mercury releases from air and other sources in accordance with the Minamata Convention on Mercury.</p> |

| Provision of the Minamata Convention | Relevant Act, legislation and regulation | Policy and Legislative Gap Analysis (if present) | Proposed Legal Reform Action (if needed) |
|--|--|---|---|
| | <p>Regulations (Chapter 2401-31)</p> <ul style="list-style-type: none"> • Marine and Freshwater Quality Regulations (Chapter 2401-11) • Wastewater Treatment and Disposal Regulations (Chapter 2401-13) • Ozone Layer Protection Regulations (Chapter 2401-81) <p>Environmental Health Regulations, 2004</p> <p>National Solid Waste Management Strategy: The Roadmap towards a Clean and Safe Palau 2017 to 2026</p> <p>Palau Climate Change Policy 2015</p> | <p>standards are based on thresholds for more industrial activities that are not relevant to Palau.</p> <p>Mercury thresholds for marine and freshwater sources as well as wastewater treatment facilities are adequately addressed under their respective regulations.</p> <p>Management of mercury releases to land from major point sources such as solid waste is generally addressed under the Solid Waste Management Regulations.</p> | <p>The inclusion of measures to address mercury releases (and other pollutants) should continue to be factored into any further iterations of environmental strategies and policies.</p> |
| <u>Article 12: Contaminated Sites</u> | National Code Title 24- Environmental Protection | Under the National Code: Title 24, the role of the EQPB for environmental management may broadly include the identification and assessment of potential mercury hotspots or contaminated sites. | Specific reforms for endeavouring to develop strategies to identify and assess potential mercury hotspots or contaminated sites may not be needed by can be considered for inclusion under the proposed regulation or policy to recognise the implementation of the overall obligations of the Minamata Convention. |

| Provision of the Minamata Convention | Relevant Act, legislation and regulation | Policy and Legislative Gap Analysis (if present) | Proposed Legal Reform Action (if needed) |
|--|---|--|--|
| <u>Article 16: Health Aspects</u> | National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health | <p>The Director of the Bureau of Public Health, under the National Code-Title 34 is expected to provide guidance on matters of public health concern.</p> <p>Additionally, under the Code, the Palau Board of Health Professions, regulations may be developed for health professional education programs.</p> <p>Currently no measures are in place for the development and implementation of strategies and programmes to identify and protect populations at risk, particularly vulnerable populations from mercury or other potential hazardous chemicals.</p> | <p>Under the National Code identified, the framework is in place for the development of health-related initiatives for mercury monitoring, treatment and educational awareness.</p> <p>The inclusion of strategies to identify and protect at-risk populations from the health impacts of mercury and other potential pollutants should be considered for inclusion in a regulation for implementation of the obligations of the Minamata Convention.</p> |
| <u>Article 19</u> Research, development and monitoring | <p>National Code- Title 27: Fishing- Chapter 1: Fishery Zones and Regulation for Foreign Fishing, Sub-Chapter II Ministry of Natural Resources, Environment and Tourism</p> <p>National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health</p> | <p>The Sub-chapter under National Code: Title 27, broadly notes that the Ministry of Natural Resources, Environment and Tourism can adopt regulations for the conservation, management and exploitation of all living resources in the surrounding waters of Palau. Specific activities for biomonitoring of fisheries is not noted.</p> <p>Under National Code: Title 34, the Director of the Bureau of Public Health has duties to encourage health-related scientific investigation.</p> | <p>Under the mentioned National Codes, the duties of the Ministry of Health & Human Services and Ministry of Natural Resources, Environment and Tourism to carry out activities for mercury research, development and monitoring are broadly defined.</p> <p>Consideration to formally recognise the specific recommendations under Article 19 for research, development and monitoring as part of the previously recommended regulation under the Environmental Quality Protection Act, to specify the obligations under the Minamata Convention can be made.</p> |

3.3 Institutional Framework Assessment

Table 21 summarises the national institutions and functions relevant to the implementation of the key obligations of the Minamata Convention on Mercury as outlined in Section 3.1 of this report.

Table 21: Assessment of Existing Institutions Relevant to Mercury Control Measures in Palau

| Relevant Institution | Summary of Existing Functions and Capacities | Relevance to the provisions of the Minamata Convention on Mercury and Needs for its Implementation |
|---|--|--|
| <p>Environmental Quality Protection Board (EQPB)</p> | <p>As a semi-autonomous agency of the Executive Branch of government, the EQPB’s functions include, <i>but are not limited to</i> administration and implementation of the National Environment Protection Act (including any related regulations) and; implementation of environmental protection programmes through ongoing coordination and collaboration with other national government agencies and bodies, the various state governments, as well as private entities.</p> | <p>The EQPB is responsible for:</p> <ol style="list-style-type: none"> 1. Acting as the focal point for the Minamata Convention and coordinating its implementation with related stakeholders. 2. Consulting with relevant stakeholders for the development and enforcement of regulations to manage mercury releases to air, land, water, and waste. <p>Guidance on appropriate mercury thresholds can be obtained through the Minamata Convention Secretariat. Following the Fifth Conference of the Parties for the Minamata Convention in November 2023, mercury waste thresholds for imported and exported waste were established.</p> <p>Further mechanisms to guide on the implementation of the obligations of the Minamata Convention will be provided under the GEF ISLANDS programme where, Palau will benefit from the development of draft model legislation to control mercury-added products for use by Pacific SIDS that can be tailored for adoption, and the provision of support for the sound repackaging, shipping, collection, and disposal of mercury waste.</p> <p>For enforcement of monitoring, funding opportunities can be coordinated on a national or regional approach in collaboration with bodies such as SPREP and SPC. The integration of mercury issues with other related pollutant issues for a harmonised approach to environmental protection is also recommended.</p> |

| Relevant Institution | Summary of Existing Functions and Capacities | Relevance to the provisions of the Minamata Convention on Mercury and Needs for its Implementation |
|--|---|--|
| The Bureau of Revenue, Customs and Taxation – Customs Division | Responsible for the monitoring of imported products and carrying out related functions under the Customs Regulations. | In coordination with the EQPB and relevant authorities, an import prohibition regulation to prevent the import of mercury added products as listed in Annex A Part 1 of the Minamata Convention as well as, mercury and mercury compounds, should be developed and implemented. The implementation of prohibition on these items would be further improved through the ongoing work for the adoption of the ASYCUDA World Customs Management System under the IMPACT Project. |
| Bureau of Public Works – Solid Waste Management Division | Responsible for the management of solid wastes in Palau including the operation of national disposal sites in an environmentally sound manner. Hazardous wastes are managed by the EQPB. | In coordination with the EQPB and relevant authorities, the Solid Waste Management Division should continue the implementation of its strategies for sound waste management outlined under the National Solid Waste Management Strategy and include measures for management of mercury wastes from disposed mercury added products in an environmentally sound manner. |
| Palau Public Utilities Corporation (PPUC) | A public corporation that functions to manage the national electrical power and water/wastewater systems. | Collaboration and coordination with the EQPB to build capacity for regular testing of mercury concentrations in water and wastewater according to thresholds detailed in the Marine and Freshwater Quality Regulations and Wastewater Treatment and Disposal Regulations, should be carried out in order to better inform implementation of measures to reduce mercury releases from these pathways. |
| Ministry of Health and Human Services: <ul style="list-style-type: none"> - Department of Environmental Health - Department of Oral Health - Bureau of Health Administration and Support Services | Within the Ministry, the Director of the Bureau of Public Health or duly authorised representatives within the Ministry’s departments are responsible for the maintenance and improvement of health and sanitary conditions, establishment of standards of medical and dental care and practice, encouragement of education and awareness raising in the field of health and overall supervision of government-owned healthcare centres/operations. | The overarching authorities for the implementation of the Minamata Convention must work closely with the Ministry of Health and Human Services (through its relevant departments) to: <ol style="list-style-type: none"> 1. advise the Government and dental healthcare professionals on phase down approaches for dental amalgam; 2. advise the Government and medical supply procurement personnel on phase out measures for mercury-added medical devices; 3. develop strategies to identify and protect at-risk populations from mercury impacts on health; |

| Relevant Institution | Summary of Existing Functions and Capacities | Relevance to the provisions of the Minamata Convention on Mercury and Needs for its Implementation |
|---|--|---|
| - Palau Board of Health Professions | | <ol style="list-style-type: none"> 4. coordinate the development and implementation of public awareness activities to raise awareness on potential sources of mercury pollution and its impacts on health and; 5. coordinate as appropriate for the environmentally sound management and prevention of mercury emissions due to the operation of the medical waste incinerator. |
| Ministry of Natural Resources, Environment and Tourism- Fisheries Division | Responsible for the management and development of Palau's fisheries, among other functions. | Under Article 19 Research, Development and Monitoring, the Fisheries Division should work in close collaboration with the EQPB and relevant stakeholders to conduct biomonitoring activities on fish species to determine mercury concentrations and develop plans for abatement. |
| Council of Chiefs | Comprises of a traditional leader from each State of Palau to represent the traditional chiefs in advising the President and elected officials on a variety of relevant local and regional matters. | To achieve a better understanding of the impacts of mercury on the environment and human health, biomonitoring and awareness raising are recommended. Involvement of local communities and collaboration via the Council of Chiefs is recommended to ensure representation and further empower local communities. |
| Palau Conservation Society | Functions as an NGO that, “partners with communities to preserve the nation’s unique environment, sustainable use natural resources, and perpetuate our conservation ethic for the economic and social resilience of Palau”. | As mercury is known to typically have a greater impact on the health of pregnant women, developing fetuses and children, as well as on environmental health overall, the involvement of the Palau Conservation Society in public awareness outreach and development of health strategies to inform at-risk groups is highly recommended. |
| Private Sector | Private sector stakeholders function to import and sell household products on the national market. | To phase out the import and use of mercury-added products as identified under Article 4 of the Minamata Convention, and to promote the use of safe mercury-free alternatives, engagement of the private sector in stakeholder consultations and awareness for mercury-related issues is highly recommended. |
| Palau Chamber of Commerce | Functions a non-governmental organisation that promotes the coordination of activities amongst the private sector stakeholders. | To phase out the import and use of mercury-added products as identified under Article 4 of the Minamata Convention, and to promote the use of safe mercury-free alternatives, engagement of the Chamber of Commerce in stakeholder consultations and awareness for mercury-related issues is highly recommended to promote their cooperation. |

Challenges in implementation include the limited human resource capacity and technical capacity to carry out continuous activities related to mercury management. To address this, it is important to recognise the linkages between mercury issues and issues related to other hazardous or potentially harmful chemicals and how approaches can be harmonised. It is recommended that a national working group consisting of representatives from the aforementioned institutions be established with assigned representatives from the EQPB acting as the Chair. This working group can be linked to other environmental committees that may have been or will be established to avoid duplication of work. For example, under the GEF ISLANDS project, national stakeholders will need to coordinate related environmental work under a steering committee and sub-committees. Furthermore, it is important to recognise regional linkages that can be made to further opportunities for information exchange and capacity building which is ongoing through agencies such as SPREP and SPC, among others.

3.4 Recommendations for Policy, Legislative and Institutional Capacity Strengthening

A summary of the proposed actions related to the regulatory and institutional capacity building for the accession to and implementation of the Minamata Convention is presented in Table 22.

Table 22: Summary of Applicable Regulatory Framework and Proposed Action for Implementation of the Minamata Convention

| Provision of the Minamata Convention | Relevant Institutions | Relevant Legislation | Proposed Action |
|---|---|---|---|
| <u>Article 4</u> <u>Mercury-added products</u> | <p>Customs Division</p> <p>Private Sector</p> <p>Palau Chamber of Commerce</p> <p>Ministry of Health and Human Services</p> <p>EQPB</p> | <p>Customs Regulations, 2006</p> <p>National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act</p> <p>National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health</p> | <p>Prohibition of the import of mercury, mercury compounds and mercury added products as outlined under Annex A (Part II) of the Minamata Convention and for Annex A (Part II), mercury in bulk form for dental amalgam.</p> <p>This can be done as a regulation for the overall implementation of the Minamata Convention developed under the Environmental Quality Protection Act or as part of the proposed revised Customs legislation under development through the IMPACT project.</p> <p>Coordination with the Customs Division, private sector retailers and the Chamber of Commerce to ensure the implementation of the prohibition of mercury products and the promotion of safe mercury-free alternatives.</p> <p>Coordination between the EQPB and Ministry of Health and Human Services to meet the obligations for phase down of dental amalgam is recommended.</p> <p>Promotion of safe alternatives can also include public</p> |

| Provision of the Minamata Convention | Relevant Institutions | Relevant Legislation | Proposed Action |
|--------------------------------------|--|---|--|
| | | | awareness campaigns that can involve relevant NGOs and other community bodies as appropriate. |
| <u>Article 8 Emissions</u> | EQPB Ministry of Health and Human Services: - Department of Environmental Health | Air Pollution Control Regulations (Chapter 2401-71) Environmental Health Regulations, 2004 | <p>The development of standards for mercury air emissions from waste incinerators should be addressed either by amendments to the existing air pollution regulations or through the development of a regulation specific to the management of mercury releases from air and other sources in accordance with the Minamata Convention on Mercury.</p> <p>For management of mercury emissions from the medical sector (including medical waste disposal methods like incineration), the Environmental Health Regulations adopts the EQPB regulations for air pollution and hazardous materials.</p> <p>Any health or healthcare plans and strategies for the management of healthcare waste should include mercury emission abatement measures from the operation of medical waste incinerators.</p> <p>Coordination between the EQPB and relevant departments of the Ministry of Health and Human Services to assess needs and build capacity to regularly implement monitoring of mercury emissions should be carried out.</p> |

| Provision of the Minamata Convention | Relevant Institutions | Relevant Legislation | Proposed Action |
|---|---|---|--|
| <p>Article 9 <u>Releases</u></p> | <p>EQPB PPUC</p> | <p>National Code Title 24-Environmental Protection: Chapter 1: Environmental Quality Protection Act</p> <p>Marine and Freshwater Quality Regulations (Chapter 2401-11)</p> | <p>Mercury thresholds for marine and freshwater sources are adequately addressed under their respective regulations. The development of standards for mercury releases from other sources can be addressed through the development of a regulation specific to the management of mercury releases sources in accordance with the Minamata Convention on Mercury.</p> <p>Building of capacity for the EQPB to carry out regular monitoring of mercury releases in coordination with other relevant entities is recommended through projects such as GEF ISLANDS.</p> <p>The inclusion of measures to address mercury releases (and other pollutants) should continue to be factored into any further iterations of environmental strategies and policies.</p> |
| <p>Article 11 <u>Mercury wastes</u></p> | <p>EQPB Solid Waste Management Division PPUC Ministry of Health and Human Services: - Department of Environmental Health</p> | <p>National Code Title 24-Environmental Protection: Chapter 1: Environmental Quality Protection Act:</p> <ul style="list-style-type: none"> - Solid Waste Management Regulations (Chapter 2401-31) - Wastewater Treatment and Disposal Regulations (Chapter 2401-13) <p>National Solid Waste Management Strategy: The</p> | <p>Mercury thresholds for wastewater treatment facilities are adequately addressed under their respective regulations.</p> <p>The development of standards for mercury releases from mercury wastes can be addressed through the development of a regulation specific to the management of mercury releases sources in accordance with the Minamata Convention on Mercury.</p> |

| Provision of the Minamata Convention | Relevant Institutions | Relevant Legislation | Proposed Action |
|---|---|---|--|
| | | Roadmap towards a Clean and Safe Palau 2017 to 2026 | <p>Building of capacity for the EQPB to carry out regular monitoring of mercury releases in coordination with the PPUC and Solid Waste Division is recommended through projects such as GEF ISLANDS.</p> <p>The inclusion of measures to address mercury releases (and other pollutants) in waste should continue to be factored into any further iterations of waste management strategies and policies (including for healthcare waste).</p> |
| <p><u>Article 12</u></p> <p><u>Contaminated Sites</u></p> | EQPB | National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act | <p>Specific reforms for endeavouring to develop strategies to identify and assess potential mercury hotspots or contaminated sites may not be needed by can be considered for inclusion under the proposed regulation or policy to recognise the implementation of the overall obligations of the Minamata Convention.</p> <p>The EQPB should endeavour to develop ecological mapping surveys to build upon the strategies to identify potential mercury hotspots or contaminated sites.</p> |
| <p><u>Article 16</u></p> <p><u>Health aspects</u></p> | EQPB Ministry of Health and Human Services | National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health | <p>Under the National Code identified, the framework is in place for the development of health-related initiatives for mercury monitoring, treatment and educational awareness.</p> <p>The inclusion of strategies to identify and protect at-risk populations from the health</p> |

| Provision of the Minamata Convention | Relevant Institutions | Relevant Legislation | Proposed Action |
|---|--|--|---|
| | | | <p>impacts of mercury and other potential pollutants should be considered for inclusion in a regulation for implementation of the obligations of the Minamata Convention.</p> <p>Coordination amongst entities should be carried out to develop strategies to identify and protect at-risk populations from mercury impacts on health, and coordinate the development and implementation of public awareness activities to raise awareness on potential sources of mercury pollution and its impacts on health.</p> |
| <p><u>Article 13</u> <u>Financial Resources and Mechanisms;</u></p> <p><u>Article 14</u> <u>Capacity-building, technical assistance and technology transfer;</u></p> <p><u>Article 17</u> <u>Information Exchange;</u></p> <p><u>Article 18</u> <u>Public information, education and awareness;</u></p> <p><u>Article 20</u> <u>Implementation Plans;</u></p> <p><u>Article 21</u> <u>Reporting</u></p> | <p>EQPB</p> <p><i>(in coordination with stakeholders identified in Section 3.3 of this report)</i></p> | <p>National Code Title 24- Environmental Protection: Chapter 1: Environmental Quality Protection Act</p> | <p>The responsibility of the implementation of the Minamata Convention on Mercury falls under the remit of the EQPB as the identified National Focal Point for the Convention.</p> <p>To recognise the National Focal Point's role and establish a mechanism for implementation of the Minamata Convention, a regulation under the National Environmental Quality Protection Act should be developed to provide for the implementation of obligations of the Minamata Convention on Mercury.</p> |
| <p><u>Article 19</u></p> | <p>EQPB</p> | <p>National Code- Title 27: Fishing- Chapter 1: Fishery Zones and Regulation for</p> | <p>No amendments to legislation are required.</p> |

| Provision of the Minamata Convention | Relevant Institutions | Relevant Legislation | Proposed Action |
|---|--|--|--|
| <u>Research, development and monitoring</u> | Ministry of Health and Human Services Ministry of Natural Resources, Environment and Tourism- Fisheries Division Council of Chiefs Palau Conservation Society | Foreign Fishing, Sub-Chapter II Ministry of Natural Resources, Environment and Tourism National Code- Title 34: Public Health, Safety and Welfare- Chapter 1: Bureau of Public Health | Collaboration amongst these entities responsible for environmental management, management of fisheries, health and community affairs should be promoted to develop strategies for the monitoring of mercury in humans, fish and other biota. |

Chapter 4: Identification of Populations at Risk and Gender Dimensions

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

Mercury is known to be highly toxic to human health, but its level of impact varies based on a number of factors including:

- form of mercury (methylmercury is the most toxic form of mercury to humans);
- amount of mercury the person is exposed to;
- age, sex, and condition of person exposed;
- duration of exposure;
- route of exposure; and
- dietary patterns of fish consumption (WHO, 2021a)

Figure 11 below summarises the typical ways in which humans may be exposed to mercury and its effects which can range from short-term to long-term.

| HUMAN EXPOSURE TO MERCURY AND ITS COMPOUNDS | | | | | |
|---|---|---------------------|----------------------|--|---|
| Mercury form | Source of exposure | Pathway of exposure | Absorption rate | Main excretion pathways | Toxicity |
| Elemental Hg ⁰ | Dental amalgam, air, accidental spills, worksites, food from contaminated sites | Inhalation | 75–85% | Urine, faeces | Acute: lungs, gastrointestinal tract |
| | | Ingestion | Almost no absorption | | Chronic: central nervous system, kidneys |
| | | Dermal | | | |
| Inorganic Hg ²⁺ | Cosmetics, soaps | Ingestion | 10–30% | Urine | Acute: gastrointestinal tract (vomiting, bloody diarrhoea), kidneys (nephritis) |
| | | Dermal | Can be high | | Chronic: kidneys (kidney damage), central nervous system, skin (acrodynia in children), immune system |
| Organic MeHg | Food, mother during pregnancy | Ingestion | 95% | Faeces (half life (T _{1/2}) is 45–70 days in adults) | Central nervous system, cardiovascular system |
| | | Parenteral | 100% | | |
| | | Transplacental | | | |

Figure 11: Human exposure to mercury and its compounds (WHO, 2021b).

Depending on the type of exposure, mercury can affect several functions throughout the body. Children, infants and foetuses (through their mother during pregnancy) are more susceptible to central nervous system damage that can result in long term developmental issues with brain function and motor skills (WHO, 2021b). Newborns may typically be exposed to mercury through the consumption of contaminated breastmilk. As such, new mothers, pregnant women and women who may become pregnant are also considered to be vulnerable to the effects of

mercury (WHO/UNEP, 2008). Other vulnerable groups include persons who suffer from diseases of the liver, kidney, nervous system, and lung (WHO/UNEP, 2008).

In the Pacific, research has been conducted to assess potential trends in mercury exposure. In 2018, a global study was conducted in which hair samples for 757 women of child-bearing age were analysed for mercury concentrations and it was found that 58% of samples indicated an elevated mercury body burden exceeding 1 ppm (IPEN et al., 2018). Based on the responses to surveys conducted for the sample group, frequent consumption of fish was a common trend found amongst persons with high mercury concentrations in their hair samples (IPEN et al., 2018). While Palau was not a participating country in this assessment, findings are expected to be similar for all Pacific Small Island Developing States (SIDS).

Humans are most exposed to the most toxic form of mercury, methylmercury (MeHg), through dietary consumption. Due to the presence of mercury in waterways and the bioaccumulation of mercury up the food chain, frequent consumption of mercury-contaminated fish is considered to be the most common source of methylmercury exposure to humans (WHO/UNEP, 2008). Predatory fish and large, long-living fish species tend to contain elevated levels of mercury, though further analysis of fish species should be conducted to more accurately inform this.

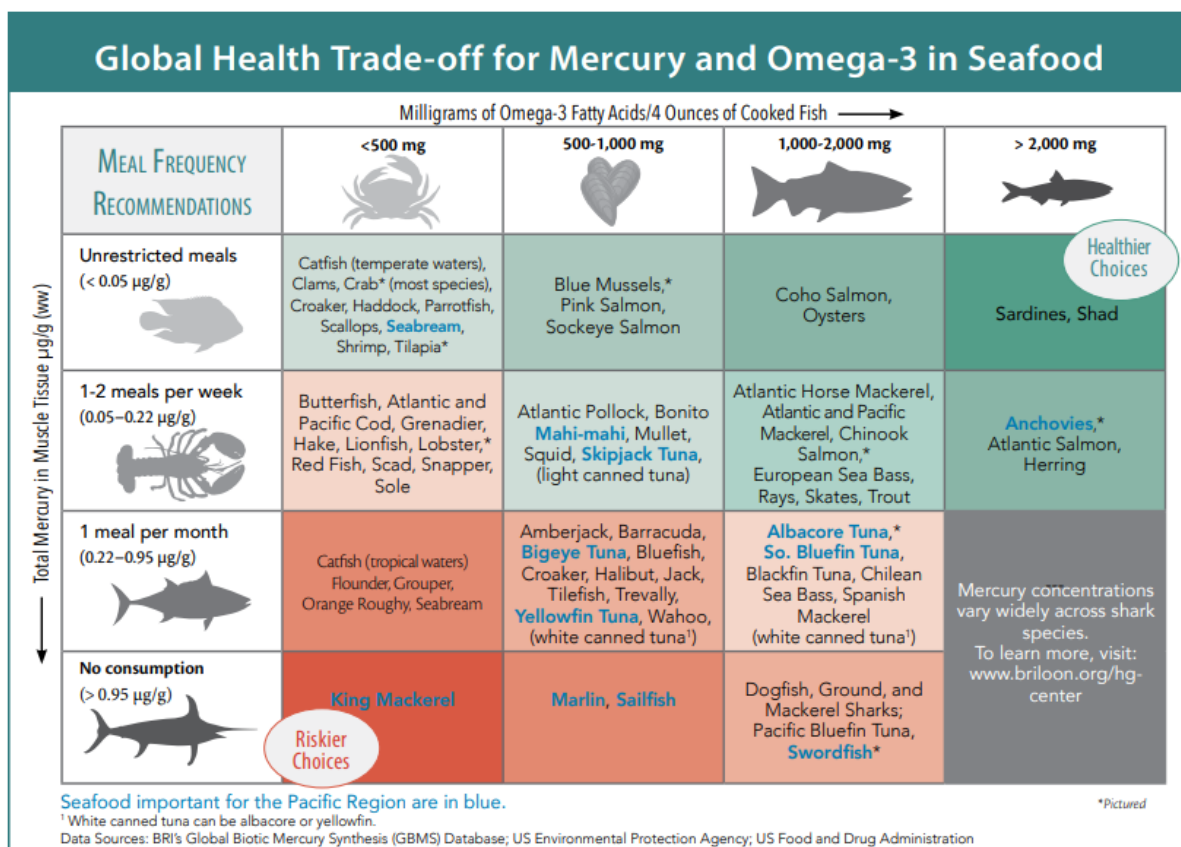


Figure 12: Example of Fish Consumption Guidelines developed for the Pacific Region (BRI, 2022).

Fish are a staple to many people in the Pacific region and other SIDS as fish are an essential source of protein that tends to be more accessible than other sources of animal protein; additionally, certain species such as tuna are exported commercially (FAO, 2022). Recognising the benefits associated with fish consumption, it is essential to educate the population on recommended consumption patterns to help limit mercury exposure to protect human health as well as the livelihoods of persons who depend on fisheries economically. Fish consumption guidelines (as illustrated in Figure 12) that are based on scientific research are recommended to assist vulnerable populations in determining the recommended frequency in consuming fish that considers their health benefits versus potential mercury risks.

In terms of occupational exposure to mercury in the Pacific, possible groups that may be affected include dental care professionals who prepare dental amalgam fillings, and waste handling and disposal personnel who may deal with mercury-containing waste.

Dental care professionals (this includes dentists and dental assistants/technicians) may be exposed to low levels of mercury when preparing dental amalgam fillings for implantation. Exposure may occur via inhalation of mercury vapors. To limit exposure, the use of proper personal protective equipment (PPE) such as face masks and gloves are recommended. Further to that, limiting the type of dental amalgam used to pre-capsulated types rather than using powdered alloys or elemental mercury will reduce the risk of exposure. In Palau, pre-capsulated amalgam is the predominant type of mercury-added amalgam used.

Many consumer products with mercury such as lighting devices and thermometers, do not pose a danger to human health while in use, but once broken, mercury can be released to the environment and to humans. During the handling of waste that may contain these items, waste workers may be routinely exposed to mercury. The use of proper PPE is recommended for all waste handlers. Diverting end-of-life mercury-added products from landfills for environmentally sound storage, handling and disposal will greatly reduce this occupational risk of exposure in the long-term.

[4.2 Assessment of Potential Gender Dimensions related to the Management of Mercury](#)

Gender mainstreaming is a strategy used to recognise the varying impacts of activities on different genders and to ensure that concerns or experiences of all genders are incorporated into the design, implementation, monitoring and evaluation of all policies and programs for the achievement of gender equality (ECOSOC, 1997).

As discussed in the previous section of this chapter, it is apparent that certain groups are more vulnerable to the effects posed by mercury and as such, mercury management strategies must be developed accordingly.

The development of future activities to continue research on the effects of mercury on the population must take into account the heightened vulnerability of women of childbearing age and pregnant women. Human biomonitoring activities to assess mercury concentrations are

typically done via biomarkers such as hair, urine, blood, and umbilical cord blood (WHO, 2021b). It is noted that results of mercury assessments on maternal hair samples can act as a proxy for determining foetal mercury exposure to further inform the overall population's mercury exposure (WHO, 2021b).

Any development and dissemination of communication materials on mercury management should include measures to ensure that materials can be easily accessed by women. For example, in the Pacific, women tend to be the primary household caretakers (PRIF, 2016); and as such communication materials on fish consumption guidelines should be widely accessible by the overall population but especially by women who may be the primary preparers of meals in the household.

In terms of occupational exposure, further research is needed to inform the gender considerations that should be implemented.

Administratively, ensuring that women are adequately represented in the committees responsible for making future decisions for mercury management in Palau, including in the development of communication strategies for mercury, is a key factor to be implemented for successful implementation. According to a summary report by UN Women (2022), gender mainstreaming and inclusion of gender and social aspects are reportedly incorporated into environmental projects and initiatives in Palau.

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

Under Article 18 of the Minamata Convention on Mercury,

“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...”*

In Palau, the risks associated with mercury releases are considered to be mainly from the use and disposal of consumer products such as CFLs and other mercury-added lighting devices; and the preparation, use and disposal of dental amalgam fillings. Other perceived mercury risks are related to the potential consumption of mercury-contaminated fish over a period of time.

Currently, the level of awareness on the risks associated with mercury amongst workers (such as dental professionals and waste disposal workers) and the general public is not considered to be high and measure should be adapted to educate these groups on the issue.

Under the MIA Project, a brief animated awareness raising video was developed for dissemination in Palau. The video aims to educate the general public on the potentially mercury-added household products that may be present, the need for the safe disposal and the promotion of mercury-free alternatives that are already popular on the local market.

It is recommended that the video be shared widely via social media by the EQPB and other national stakeholder organisations.

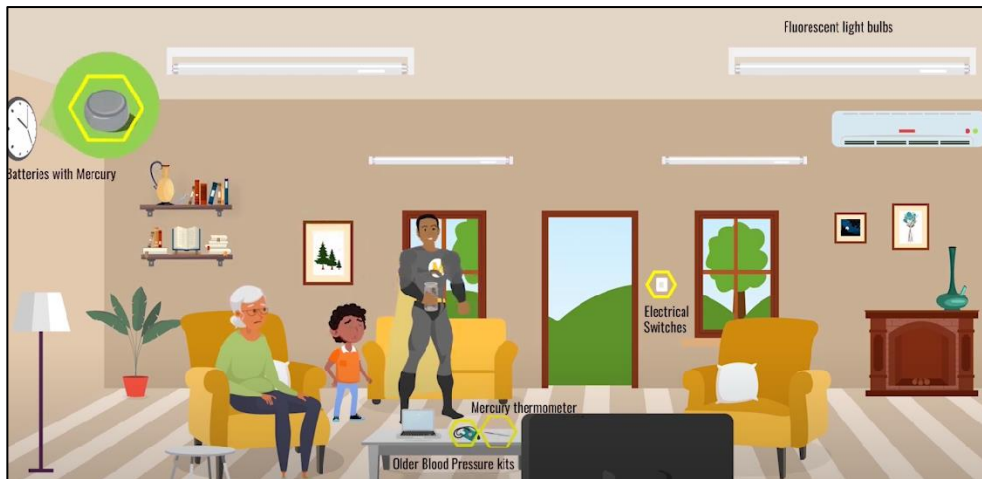


Figure 13: Scene in the awareness raising video developed under the project.

To educate key stakeholders on the estimated sources of mercury releases and recommendations for mercury management developed under the project, a technical briefing document that summarises the main findings of the MIA Project was developed.

Further to the MIA Project, Palau is also participating in the GEF ISLANDS Programme that will include information dissemination, inclusive of gender considerations, on mercury related issues to inform stakeholders and change behaviours in the Pacific region via the Coordination, Communication and Knowledge Management (CCKM) activities.

Stakeholder outreach and school campaigns to educate persons on various environmental issues are common tools implemented by government bodies responsible for the environment. The materials developed under this project and the ongoing GEF ISLANDS project, can be utilised in future public education campaigns on environmental awareness.

In order to better inform the public on the potential risks associated with consumption of fish, further information on mercury concentrations in Palau and the Pacific region is being gathered by BRI in collaboration with the EQPB.

Coordination with other relevant governmental, private and non-governmental organizations is recommended to further promote mercury management awareness.

Chapter 6: Implementation Plan and Priorities for Action

Under Article 20 of the Minamata Convention on Mercury, Parties, “may, following an initial assessment, develop and execute an implementation plan, taking into account its domestic circumstances, for meeting the obligations under this Convention” (UNEP, 2023). Further guidance on the development of an implementation plan can be obtained from the Minamata Convention Secretariat.

This Chapter serves to highlight some of the potential target areas that should be considered for the successful implementation of the Minamata Convention by the Government of Palau.

Priorities for Action:

1. Develop a Regulation to formally recognise the obligations of the Minamata Convention and facilitate its implementation.

As discussed in further detail in Chapter 3, coordination between the EQPB and other relevant stakeholders as needed, should be carried out to develop a regulation under the National Environmental Quality Protection Act. An example that can be referenced is the Ozone Layer Protection Regulations (Chapter 2401-81)- which enables the implementation of the Montreal Protocol.

The proposed Act or regulation for the Minamata Convention should not only include measures to facilitate the monitoring of mercury releases from sources and prohibition of imports of mercury, mercury compounds and mercury added products, but should also formally recognise the focal point or delegated authority’s responsibility for implementing other administrative measures such as the facilitation of information exchange and reporting requirements. This can be further reflected in updated environmental and strategic national plans, along with other relevant environmental agreements.

Further regulatory reforms and institutional considerations to prohibit imports of mercury-added products, manage mercury releases and enhance other measures for implementation of the Minamata Convention can be found in Chapter 3 of this report.

It is key to note that through participation in the ongoing GEF-funded programme, Implementing Sustainable Low and Non-Chemical Development in Small Island Developing States (ISLANDS), Palau will also benefit from the development of draft model legislation to control mercury-added products for use by Pacific SIDS that can be tailored for adoption, and the provision of support for the sound repackaging, shipping, collection, and disposal of mercury waste.

2. Establish a Coordinating Mechanism for Mercury Management

Under the GEF ISLANDS Project, a national steering committee is being formed to oversee the project’s activities (which include mercury management activities). It is recommended that this committee or a sub-committee comprising of stakeholders from all relevant authorities identified in Chapter 3 of this report, continue to coordinate on the development of activities for mercury management. A mechanism for information exchange on mercury issues amongst these stakeholders should also be established. Gender considerations must also be factored into the makeup of the committee as well as for the implementation of management activities as women and children have been identified as the more vulnerable groups to the impacts of mercury on health.

3. Implement measures to address identified sources of mercury releases.

These measures may include:

- a. **Promotion of the continued phase-out and phase down of mercury-added products.**

Mercury-added products (and other intentional products/process uses) have been identified as a major source of mercury releases in Palau. In addition to regulatory bans to phase out their importation, sensitisation of government agencies, the private and public sectors is needed to ensure the sound phase out of these products.

Mercury-free alternative products are increasingly available on the global and local markets and have been proven to be highly reliable replacements. A summarised list for some key mercury-added products and their readily available alternatives is provided in Table 25.

Table 23: Summarised List of Key Mercury-added Products and their Mercury-free Alternatives

| Mercury-added Product | Mercury-free Alternative |
|--|--|
| CFLs, LFLs, Mercury Vapour Lamps, some HIDLs | Light Emitting Diodes (LEDs), mercury-free HIDLs |
| Mercury thermometers | Digital thermometers, infra-red no-contact thermometers, alcohol thermometers |
| Mercury-added electrical switches, relays and thermostats such as, mercury wetted reed relays and mercury thermostats. | Mercury-free switches; mercury-free relays; electromechanical or digital thermostats <i>(over the past 20 years, mercury-free electrical switches, relays and thermostats have become the predominant type on the global market)</i> |
| Blood pressure medical measuring devices such as Mercury-added sphygmomanometers | Aneroid sphygmomanometers and several types of automated (electronic) blood pressure gauges. |

| | |
|--|--|
| Mercury-added batteries such as: Mercury Oxide/Mercury-Zinc Batteries, Zinc-air Button Cells, Alkaline Button Cells, Silver Oxide Button Cells, Alkaline, other than button. | Most of these types of alkaline and button cell batteries are now mercury-free on the global market. |
| Dental mercury amalgam (fillings) | Composite (resin) fillings |
| Mercury-added Skin Lightening Products | Global databases are currently under development and many existing databases are available online to guide on skin lightening products that should be avoided due to mercury contamination or other harmful ingredients. |

For dental amalgam, under Article 4, Annex A, Part II of the Convention, Parties are expected to phase down dental amalgam by taking at least 2 provisions specified. Some key provisions for consideration by stakeholders in Palau include:

- Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration;
- Encouraging representative professionals to educate and train dental professionals on the use of mercury-free dental restoration alternatives and on promoting best management practices;
- Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land.

Furthermore, as of 2022, Parties shall, “exclude or not allow, by taking measures as appropriate, the use of mercury in bulk form by dental practitioners” and Parties are expected to, “take appropriate measures to prevent dental amalgam use for patients under 15 years of age, and of pregnant and breastfeeding women, except when considered necessary”.

b. Ensuring BAT/BEP implementation for monitoring and preventing mercury releases from sources such as landfills and waste incinerators.

Close coordination amongst stakeholders across the government and private sector to build capacity and infrastructure for sound waste management is key to reducing mercury releases from major sources. The incorporation of mercury management under national waste strategies and training of relevant personnel in the subject is highly recommended.

4. Public awareness and sensitisation of relevant stakeholders on mercury issues

It is recommended that greater awareness and education of the general public and key stakeholders through existing outreach programmes be carried out. Further details on this priority are provided in Chapter 5 of this report.

5. Strengthen understanding of mercury issues in Palau through monitoring programmes.

To enhance the understanding of the risks posed by mercury locally, efforts to enhance strategies to identify potential mercury hotspots in the local environment through mapping and monitoring programmes can be coordinated. Partnering with regional and global organisations like SPREP, the UNEP Global Mercury Partnership and BRI, among others for the development of funded projects to enhance monitoring capabilities can be assessed. Currently global mercury monitoring activities are being conducted by organisations such as BRI for the collection and analysis of human hair samples, fish muscle tissue samples, blood, feather and egg samples from birds and blood or fur samples from bats. Data generated will contribute to a global mercury database in coordination with UNEP.

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Annex 1: UNEP TOOLKIT Calculation Spreadsheet

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

<https://docs.google.com/spreadsheets/d/1->

[EAp_aB05yYEcEgaR7zzltkf0PrNoC3q/edit?usp=drive_link&oid=111368229179989433735&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1-EAp_aB05yYEcEgaR7zzltkf0PrNoC3q/edit?usp=drive_link&oid=111368229179989433735&rtpof=true&sd=true)