NATIONAL REPORT FOR THE POPS GLOBAL MONITORING PLAN

Barbados 2022

ABSTRACT

An account of the implementation of the GMP II project in Barbados including the activities undertaken, findings and recommendations.

prepared by:

ENVIRONMENTAL PROTECTION DEPARTMENT

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LIST OF ABBREVIATIONS

BCCC-SCRC	Basel Convention Coordinating Centre and Stockholm Convention Regional Centre for Latin America and the Caribbean
CARPHA	Caribbean Public Health Agency
COP 7	The Seventh Conference of the Parties to the Stockholm Convention
EEE	Electric and Electronic Equipment
EPD	Environmental Protection Department
FST	The Faculty of Science and Technology at the University of the West Indies, Cave Hill Campus
GAPS	Global Atmospheric Passive Sampling Programme
GEF	Global Environment Facility
GMP I	Capacity Building for POPs Analysis to Support the Global Monitoring Plan of POPs for Effectiveness Evaluation of the Stockholm Convention
GMP II	Supporting the Implementation of the Global Monitoring Plan of POPs in Latin American and Caribbean States
HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
HCHs	Hexachlorocyclohexane
LATU	Technological Laboratory of Uruguay
NIP	National Implementation Plan
OCPs	Organochlorine Pesticides
PBDEs	Polybrominated Diphenyl Ethers
PCB	Polychlorinated Biphenyls
PeCBs	Pentachlorobenzene
PFHxS	Perfluorohexane sulfonic acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonic Acid and its Salts
PFSO-F	Perfluorooctane Sulfonyl Fluoride
POPs	Persistent Organic Pollutants
QA/QC	Quality Assurance/ Quality Control
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization

EXECUTIVE SUMMARY

In 2016, the Government of Barbados entered a Memorandum of Understanding with the Basel Convention Coordinating Centre and Stockholm Convention Regional Centre for Latin America and the Caribbean (BCCC-SCRC) - Technological Laboratory of Uruguay (LATU) to undertake a project entitled, "*Supporting the Implementation of the Global Monitoring Plan of POPs in Latin American and Caribbean States"*. The project sought to enable participating countries to contribute to the Global POPs Monitoring Plan on persistent organic pollutants (POPs) to support the implementation of the Stockholm Convention.

The project involved the collection of air sampling using polyurethane foam disks that were deployed quarterly over a period of two years; and collecting samples of human milk, meat, vegetable, fish, chicken eggs, soil and sediment for analysis. A component of the project also involved training representatives from the Governmental Analytical Services, Forensics Sciences Centre and Faculty of Science and Technology at University of the West Indies, Cave Hill Campus, to perform chemical analysis for various POPs.

Due to several reasons, the air, milk and national samples collected for the project were not analysed by the local laboratory and remain in refrigerated storage. However, data obtained from the international laboratories revealed the following:

- relatively high concentrations of chlordanes and drins were detected in the air samples;
- approximately 20 nanograms per gram of lipid of non-dioxin like PCBs were found in the 2018 human milk sample from Barbados which was the highest of all the countries in Latin American and the Caribbean over the period 2016-2019;
- organochlorine pesticides, organobromo susbstances industrial chemicals were detected in the pooled sample but levels decreased in comparison to the sample collected in 2010; and
- PFOS and PFOA were detected in the samples of national interest. The concentrations, particularly those for PFOS, were markedly higher in the sediment and soil samples in comparison to the egg and fish samples.

It is anticipated that the knowledge and experience gained will be used to establish a national POPs monitoring programme, which will involve setting-up sampling locations across the island, having the samples analysed locally to maintain the skills gained during the project and monitoring monitor trends and devising any necessary interventions. Ultimately, the data generated from the local monitoring network could provide an impetus for decision-makers to prioritize policies and regulatory mechanisms related to the sound management of POPs. Additionally, the data can help Barbados to fulfil its reporting obligations under the Stockholm Convention for the Management of Persistent Organic Pollutants.

To this end, the following are recommended:

- EPD should submit a formal request to use the unspent funds from the project to continue to assess the presence of POPs in the local environment. These funds could be used to purchase PUF disks and additional samplers (if necessary) to continue to collect samples of air and analyse other media of national interest such soil and sediment from around the island. These samples will be analysed locally to maintain the capacity developed during the GMP II project.

- Projects should be designed, developed and implemented to determine how POPs are being introduced to the Barbadian environment and practicable corrective measures proposed.

1 Introduction

Barbados is the most easterly island in the Caribbean, located at 13°10' N 59°32' W, with a land area of approximately 166 square miles (430 square kilometres). On November 30, 2021, Barbados transitioned from a parliamentary constitutional monarchy under the hereditary monarch of Barbados (Queen Elizabeth II) to a parliamentary republic with a ceremonial indirectly elected president as head of state. The Prime Minister remains the Head of Government. English is the official language; however, a local English dialect exists.

As of the July 2021, 301,865 persons were estimated to be resident on the island. The median age was 39.5 years with most of the population between the ages of 15 and 64. The male to female birth ratio was 1.01. (Government of Barbados, n.d.)

Historically, the Barbadian economy had been dependent on agriculture, mainly sugarcane cultivation and related activities, but has made the transition to an 'innovation driven' economy. The main driver of economic growth is the service sector, which is led by tourism, international business and financial services (CDB & GoB, 2012.)

Barbados acceded to the Stockholm Convention on June 7, 2004. The initial National Implementation Plan (NIP) for Barbados was developed under a project entitled *Development of National Implementation Plans for the Management of Persistent Organic Pollutants in Barbados*. The national project was a component of an overall initiative by the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF) to facilitate the development of NIPs in developing countries and countries with economies in transition; thus, enabling those countries to begin to meet their obligations under the Stockholm Convention. Barbados was one of twelve (12) countries selected to participate in the project. The project was managed by UNEP, financed by the GEF, and Barbados received co-financing from the government of Germany (Barbados NIP, 2007). The objective of the project was to develop a National Implementation Plan (NIP) for the management of POPs in Barbados and address the initial twelve (12) POPs. The outputs of the project included:

- National Inventory of Releases of Dioxins and Furans (2003);
- National Inventory of Polychlorinated Biphenyls (2004);
- National Inventory of Pesticides (2003 – 2004);
- National Profile of Chemicals Management in Barbados (2004) (an assessment of the legal, institutional, administrative and technical aspects of chemical management in Barbados); and
- National Implementation Plan for the Management of Persistent Organic Pollutants.

The NIP was endorsed by the Cabinet of Barbados and submitted to the Secretariat of the Stockholm Convention on October 12, 2007.

During the period 2017 to 2019, the NIP was updated as part of the GEF #5558 project titled *Development and Implementation of a Sustainable Management Mechanism for Persistent Organic Pollutants in the Caribbean*. The project was executed by the Basel Convention Regional Centre for the Training and Technology Transfer in the Caribbean (BCRC-Caribbean) and implemented by the United Nations Industrial Development Organization (UNIDO). The Caribbean Public Health Agency (CARPHA) was contracted as the technical consultant to execute Output 1.1 of the project, which involved the update of the NIP including conducting in-country inventories of new POPs added to the Stockholm Convention.

The updated NIP addressed the initial twelve (12) POPs and chemicals that were added to the Annexes of the Stockholm Convention up to Seventh Conference of the Parties (COP 7) in May 2015. The POPs listed in 2017 were not assessed in this updated NIP; however, activities are proposed in the action plan to address these POPs in future. The two (2) POPs listed in 2019, dicofol and PFOA, its salts and PFOA-related compounds are not addressed in the NIP and will be considered in the next update.

In general, the assessment of all POPs groups shows that products containing POPs may be prevalent in a wide range of consumer products (EEE, cars, textiles, carpets, paints adhesives, clothes, kitchen utensils, etc.) and that the proper management and disposal of these products has to be addressed. Similarly, potentially contaminated sites are present due to historic and or current POP-related activities and these sites must be mapped, tested, managed and remediated. Additionally, several national priorities were recognized including the need to develop or amend legislation for the sound management of chemicals and waste including POPs and to assess the risk to groundwater and drinking water by PFOS (and other POPs) and the current contamination status.

To build capacity at the national level to test for POPs, and pursuant to the objective of the initial NIP, from 2008 to 2011, the governments of the Bahamas, Barbados, and Haiti undertook a project entitled, "Capacity building for POPs analysis to support the Global Monitoring Plan of POPs for effectiveness evaluation of the Stockholm Convention". The project (hereafter referred to as GMP I) sought to enable these countries to contribute to the Global POPs Monitoring Plan to support implementation of the Stockholm Convention. The objectives of the project were to enable Caribbean countries to perform POPs analysis; and increase regional cooperation between laboratories responsible for POPs analysis. Unfortunately, local analysis of the mother's milk, air and national samples was not possible due to numerous instrumental problems at the local laboratory.

In 2016, the Government of Barbados entered into a Memorandum of Understanding with the Basel Convention Coordinating Centre and Stockholm Convention Regional Centre for Latin America and the Caribbean (BCCC-SCRC) - Technological Laboratory of Uruguay (LATU) to undertake a project entitled, "*Supporting the Implementation of the Global Monitoring Plan of POPs in Latin American and Caribbean States"* (hereafter referenced as the GMP II project).

The project sought to enable these countries to contribute to the Global POPs Monitoring Plan to support the implementation of the Stockholm Convention.

The monitoring data on Persistent Organic Pollutants (POPs) differs widely between regions but are essential to establish the level of the threat in different regions of the world and to evaluate the effectiveness of the measures undertaken by Parties under the Stockholm Convention. Typically, Caribbean countries have at least one laboratory outfitted with equipment for the analysis of POPs. Very often, the laboratories have adequate infrastructure and institutional support but lack training and spares/consumables to do such analysis according to international standards. Consequently, there is limited ability to test for POPs in the Caribbean.

The Faculty of Science and Technology at the University of the West Indies, Cave Hill Campus (FST), was one such laboratory in the Caribbean that had the necessary infrastructure to test for POPs but the staff could benefit from training in this regard. Training in the analysis of samples in various matrices for POPs would allow Barbados to pursue national objectives as outlined in its 2007 National Implementation Plan for the Management of Persistent Organic Pollutants (NIP). Two of the activities proposed in Barbados' NIP (2007) were:

- screening of potentially PCB-containing equipment to determine the presence and concentration of PCBs; and

- analysing pesticide wastes identified during the national pesticides inventory to assess the presence of POPs.

It should be noted that, the screening of the potentially PCB-contaning equipment was undertaken in 2016 as a part of the GEF 5558 project by the BCRC-Caribbean. However all the equipment sampled were deemed PCB-free. Additionally, stockpiles of obsolete pesticides and four capacitors was disposed of during the FAO/GEF 5407 project.

With the experience gained from this project, similar tasks can be undertaken more economically than if samples were collected and shipped overseas for analysis. Having samples analysed locally also avoids the potential adverse impacts associated with the logistics and delays of shipping. Moreover, it would facilitate a greater understanding of the impact the POPs are having in Barbados and allow decision-makers to put appropriate mitigation and control measures in place.

2 Organization Arrangements

Figure 1 depicts the lead agencies, the Environmental Protection Department and Faculty of Science and Technology of the University of the West Indies, Cave Hill Campus, involved in the project and their respective responsibilities.

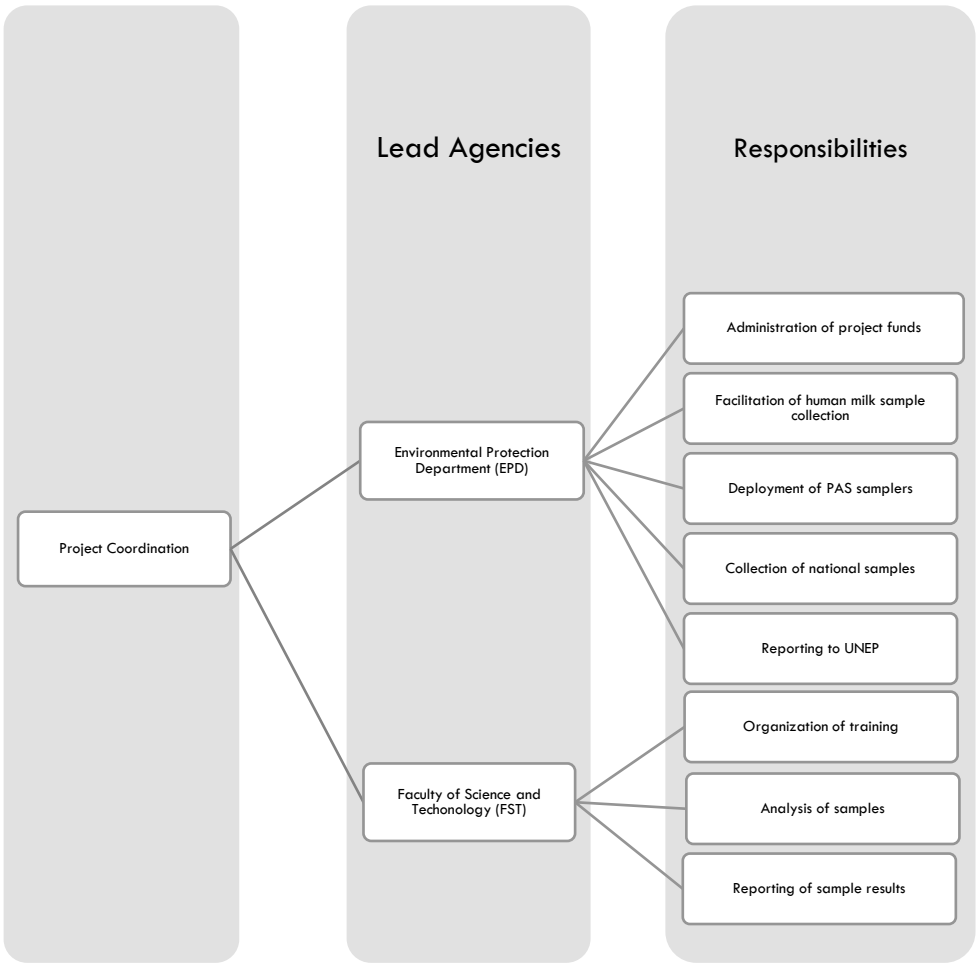

Figure 1: Organizational Structure of the Project

Mr. Anthony Headley, Director of the Environmental Protection Department, was the coordinator for the project. The Environmental Protection Department (EPD), which is a department under the Ministry of Environment and National Beautification, Green and Blue Economy was established in 1971. The Department's responsibilities include the regulation, management and control of activities, which may have an adverse impact on the environment and human health. Its mission is to protect residents, visitors and the environment from the harmful effects of pollution through the promotion of sustainable practices, education, partnerships and the enforcement of legislation.

At its core, science probes the essence of things, technology benefits humankind by applying its findings, and the community of researchers at the Faculty of Science and Technology of the University of the West Indies, Cave Hill Campus – students, faculty, and staff – engage in

world-class scientific inquiry, aimed at addressing issues facing not only our region but the world at large.

As of June 27, 2022, $82,364.00 USD was spent to complete the air sampling, human milk survey national interest samples, shipping the sample overseas for analysis and purchasing of consumables to facilitate local analysis and support the objective of the projects.

3 National Activities

3.1 Air Sampling

The air samplers were situated at the Caribbean Institute for Meteorology and Hydrology (CIMH) in what is classified as an urban area as indicated in the Physical Development Plan (2003). This site was selected because:

- CIMH allowed easy and unrestricted access to the location by EPD personnel,
- there was little risk of tampering of the samplers,
- the location presented an opportunity to observe levels of POPs in an urban area, and
- meteorological data was available for this site (if required).

The air sampling programme ran for two years. Table 1 below summarizes the periods of deployments over the two years. Eleven polyurethane foam (PUF) disks were deployed quarterly. At the end of each quarter, six disks were shipped to the overseas laboratories for analysis and five were retained to be analysed by the local laboratory.

Table 1: Deployment Periods for PUF Disks

Year	Campaign	Deployment Period
2017	I	December 30, 2016, to April 1, 2017
	II	April 1, 2017, to July 1, 2017
	III	July 1, 2017, to October 2, 2017
	IV	October 2, 2017, to January 2, 2018
2018	I	January 2, 2018, to April 4, 2018
	II	April 4, 2018, to July 3, 2018
	III	July 3, 2018, to October 9, 2018
	IV	October 9, 2018, to January 3, 2019

3.2 Water Sampling

A component of the project was to, inter alia, identify the regional water sampling sites, and provide adequate equipment and materials for sampling. Barbados did not participate in this component of the project.

3.3 Human Milk Survey

The collection of the samples of human milk comprised four stages. These were as follows:

- Seeking permission from local ethics board,
- Seeking assistance from the Ministry of Health regarding the collection of samples,
- Collecting of the samples of human milk, and
- Analysing the samples.

The EPD applied to the local ethics board to obtain permission to undertake the collection of the samples of human milk. The local ethics board comprised representatives from the Ministry of Health and the University of the West Indies. The application outlined, *inter alia*, the protocols for ensuring confidentiality, a brief assessment of the risk and benefits of the project, a description of the participants and the selection criteria, and the purpose of the research. The Department received approval from the ethics board on September 13, 2016.

After the EPD obtained approval from the ethics board, the EPD obtained contact information through the Ministry of Health to facilitate the identification of potential mothers for the study. Due to the limited time to collect the required minimum number of 50 samples, the Department decided to screen postnatal mothers. Screening of the mothers was conducted according to the procedure outlined in the "UNEP-coordinated Survey of Human Milk for Persistent Organic Pollutants: Guidelines for Organization, Sampling and Analysis (2017)".

With the assistance of the Ministry of Health, the Department identified and contracted two retired nurses to contact potential candidates for the study and collect the 50 ml samples from eligible and consenting participants. Samples were collected over the period July to September 2017. Collected samples were stored at 4^{o}C and transported to the FST (on the same day that they were collected or as soon as practicable) where they were stored at -18^{o}C.

Samples were collected from 51 primiparae (first-time mothers) with an average age of 21.3 years. The mothers were breastfeeding only one child (i.e. no twins), resided in the area for at least the previous 10 years, and were available for sample collection within 3 to 8 weeks of delivery. Additionally, the mother reportedly had a normal pregnancy and both the mother and child appeared to be healthy. The following (Table 2and Table 3) is a summary of the descriptive characteristics of the mothers who gave samples.

Table 2: Summary Information for Pooled Sample

Parameter		**Value**
Ages of the mothers (years)	Mean	21.3
	Range	25
Mother's height (cm)	Mean	165.6
	Range	31
Mother's weight before pregnancy (kg)	Mean	67.4
	Range	78
Child's age at sampling (weeks)	Mean	4.7
	Range	5
Area of residence during last 10 years: (% of the total mothers of the pool)	Urban	21.6
	Rural	25.5
Mother's dietary habits (% of total mothers in the pool)	Mixed diet	98
	Vegetarian but with milk and egg	0
	Strictly vegetarian	2
	Other	0
Mother born in the country (% of total mothers in the pool)		-
Mother raised by breastfeeding (% of total mothers in the pool)		94.1
Mother's mother born in the country (% of total mothers in the pool)		70.6
Mothers working before pregnancy (% of total mothers in the pool)		80.4
Exposure to DDT from inside house spraying to prevent mosquitoes (% of total mothers in the pool)		0
Mothers whose current weight is less than their weight before pregnancy (% of total mothers in the pool)		27.5
Type of fish mother consumed most often (% of the mother in the pool)	Fish from the sea	94.1
	Fresh fish	0
	Both	0
	No fish	5.9

Table 3: Mother's Consumption of Food (Percentage of Mothers in the Pool)

	Fish / %	Marine Mammals / %	Seafood other than fish and mammals / %	Milk and milk products / %	Meat & Poultry / %	Eggs / %
Never	**4**	**49**	**65**	**2**	**2**	**8**
Less than once a week	**14**	**20**	**24**	**4**	**0**	**22**
Once a week	**16**	**12**	**0**	**0**	**0**	**4**
Twice or less a week	**25**	**8**	**2**	**6**	**2**	**29**
More than twice a week by not every day	**33**	**4**	**2**	**41**	**45**	**18**
Every day	**4**	**0**	**0**	**43**	**49**	**18**
No response	**4**	**7**	**7**	**4**	**2**	**1**

3.4 National Samples

At the national level, Barbados collected samples of various media for analysis. The choice of samples collected sought to assess the level of human exposure to POPs and levels of the POPs in the environment. To gauge human exposure samples of pork, tomatoes, sweet potatoes, chicken eggs and fish (a reef fish species and a pelagic fish species) were collected for analysis while soil and sediment were collected to determine the levels in the environment.

A large proportion of the mothers who donated samples of human milk indicated that fish was part of their diet. Therefore, investigating this food source was thought to be prudent. Fish samples were obtained from a local fisherman.

The samples were dried, homogenized and divided. Portions were sent to an international laboratory while the remainders were retained to be analysed by the local laboratory.

A first set of national samples was sent to CSIC in Spain where some of the samples were to be retained for analysis and the reminder re-packaged for onward submission to the MTM laboratory in Sweden to be tested. However, the shipment was denied entry by the Spanish customs authorities and returned, even though all of the recommended protocols were followed, and subsequently destroyed by the port authorities in Barbados.

A second set of national samples were prepared and sent directly to the MTM laboratory but there was spoilage and despite efforts to salvage the contents, it appeared that the pork and vegetable samples could not be saved.

The portion of the national samples that were retained for analysis by the local laboratory are currently stored at -18°C.

3.5 International Inter-Calibration Study

Barbados did not participate in the inter-calibration study due to time constraints.

4 Capacity Building Activities

Representatives from the Governmental Analytical Services, Forensics Sciences Centre and Faculty of Science and Technology participated in training sessions on performing chemical analysis for persistent organic pollutants (POPs). The training ran daily from May 28 to June 1, 2018, at the University of the West Indies, Cave Hill Campus. The training served to build local laboratory capacity to test, not only the twelve initial POPs but the POPs added to the annexes of the Stockholm Convention in 2015.

The aim of the training was to build capacity in local laboratories for the analysis of the variety of analytes in environmental matrices. Attention was paid to, *inter alia*, sampling, sample handling, sample storage, extraction, clean-up of samples, gas chromatography, reporting and various aspects of quality assurance and quality control (QA/QC) such as method validation, blanks, calibration, internal standards, reference materials, the limits of detection and the limits of quantification.

Additionally, representatives from FST and EPD participated in "*Training on the Management and Interpretation of POPs Data*" on August 31, September 2, 7, 9, 14 and 16, 2021. The GMP II project assisted participating countries in conducting POPs analyses on different environmental media such as air, breast milk, water and matrices of national interest. The technical training on POPs data interpretation contributed to the preparation of the project final report, as well as to ensure correct communication of POPs risks at all levels and in the planning of next steps for POPs monitoring.

5 Involvement in Other Monitoring Activities and Network

Barbados is also involved in the monitoring of POPs under the Global Atmospheric Passive Sampling Programme (GAPS), which involves the deployment and collection of sampling media conducted quarterly. The collected media were sent overseas and analysed by Environment Canada. The GAPS network is a global research survey that monitors the presence of Persistent Organic Pollutants and other chemicals in the air. The data obtained will allow for a comparison of sites around the world.

6 Sustainability Plan

It is anticipated that the knowledge and experience gained will be used to establish a national POPs monitoring programme, which will involve setting-up sampling locations across the island, having the samples analysed locally to maintain the skills gained during the project and monitoring monitor trends and devising any necessary interventions. Moreover, the data generated from the local monitoring network could provide an impetus for decision-makers to prioritize policies and regulatory mechanisms related to the sound management of POPs. Additionally, the data can help Barbados to fulfil its reporting obligations under the Stockholm Convention for the Management of Persistent Organic Pollutants and to develop communication material for policymakers and other key stakeholder groups.

7 Results and Achievements

Due to several reasons, the air, milk and national samples collected for the GMP II project were not analysed by the local laboratory and remain in refrigerated storage. Consequently, what follows is a synopsis based on the results obtained from the international laboratories that analysed the mirrored samples.

Contributory Factors to the Delay in Sample Analysis:

- Lockdowns and restricted movement associated with the COVID-19 pandemic.
- Volcanic ash fall

The passive air sampling campaigns conducted over the period 2017 to 2018, detected amounts of the following groups of POPs: chlordanes, Drins, DDTs, Heptachlors, HCHs, Mirex, Endosulfans, HCB, PeCBs, PCB, PBDEs, HBCD, PFOS, PFOA, and PFHxS. Most notable was the relatively high concentrations of chlordanes (cis-chlordane (42.29 pg/m3 and oxy-chlorodane 2.68 pg/m^3) and drins (aldrin 11.41 pg/m3 and dieldrin 345.26 pg/m3) recorded. The median concentration of drins observed was greater than the concentrations recorded in other countries in Latin America and the Caribbean.

In comparison to the concentrations of the other parameters tested, it was noted that not only were the levels of drins and chlordanes elevated during GMP II, the concentrations of heptachlor, HCB and HCH were also elevated.

With respect to the pooled sample of human milk collected in 2018, the following were observed, and comparisons made to the sample collected in 2010 during the GMP I project:

- Dioxin-like compounds such as dioxins and furans were detected in the pooled sample: approximately 4 picograms per gram of lipid. In comparison to the levels recorded in 2010, there was a reduction of almost 2 picograms per gram of lipid.
- Approximately, 20 nanograms per gram of lipid of non-dioxin like PCBs were found, which was roughly 5 nanograms per gram of lipid less than the value recorded in 2010. It should be noted that the value observed in the 2018 human milk sample from Barbados was the highest of all the countries in Latin American and the Caribbean over the period 2016-2019.
- Organochlorine pesticides and industrial chemicals were detected in the pooled sample: the concentration of DDT, an insecticide used in agriculture, decreased from roughly 175 micrograms per kilogram of lipid in 2010 to 100 micrograms per kilogram of lipid in 2018; the gamma isomer of hexachlorocyclohexane (HCH), known as lindane, has insecticidal properties but due the metabolization the beta isomer accumulates in humans and was found to have decreased from 6 micrograms per kilogram of lipid in 2010 to 3 micrograms per kilogram in 2018; and the concentration of hexachlorobenzene (HCB), a fungicide, decreased from 3.5 micrograms per kilogram of lipid to 3 micrograms per kilogram of lipid in 2018.
- Organobromine substances such as polybrominated diphenyl ethers (PBDEs) were found: 5 micrograms per kilogram of lipid in 2018 in comparison to 8 micrograms per kilogram in 2010.
- Concentrations of 13.1 pg/l and 19.6 pg/l for PFOS and PFOA respectively. Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F) have widespread use in electric and electronic parts, firefighting foam, photo imaging, hydraulic fluids and textile. Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds. PFOA, its salts and PFOA-related compounds are used widely in the production of non-stick kitchen ware, food processing equipment, surfactants and surface treatment agents in textiles, paper and paints and firefighting foams. The following are notable:
    - These substances were listed as POPs in the 2010 and, therefore, were not tested for in 2010.
    - The concentration PFOA (19.6 ng/l) in human milk for Barbados was greater than then median concentration of samples analysed from nine countries in Latin America and the Caribbean.
- Perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS-related compounds, which are proposed for listing under the Stockholm Convention, were not detected. These substances are utilized in consumer goods such as carpets, leather, apparel, textiles, firefighting foam, papermaking, printing inks, sealants and non-stick cookware.

PFOS and PFOA were detected in the samples of national interest. The concentrations, particularly those for PFOS, were markedly higher in the sediment and soil samples compared to the egg and fish samples.

PBDEs are used as flame retardants and have been used in a variety of products, including building materials, electronics, furnishings, motor vehicles, aeroplanes, plastics, polyurethane foams, and textiles. PCBs are oily liquids or solids that are resistant to extreme temperature and pressure and were used commonly in electrical equipment like capacitors and transformers. Dioxins and furans are formed primarily as a by-product of incomplete combustion processes. Drins refers collectively to the pesticides Aldrin, Eldrin and Dieldrin. All these substances persist in the environment and can impact negatively on human health.

Despite the regular collection of municipal waste by the local sanitation authorities, a common practice in Barbados is 'back yard' or "open" burning. Since Barbados is not a large consumer of flame retardants and the use of PCBs have been prohibited, open burning could be a means by which these substances were introduced into the atmosphere. The method of introduction of these compounds into the air needs to be investigated and the design of the proposed local monitoring programme should take the practice of open burning into consideration.

Additionally, the source(s) by which the drins are introduced into the environment needs to be investigated since the importation of the chemicals into Barbados is prohibited.

8 Conclusion and Recommendations

The most notable outcomes of the project were that the personnel at the various laboratories in Barbados have greater awareness of international standards for POPs analysis and can submit high quality data to the GMP in the future. Additionally, this increased technical capacity could facilitate the establishment of the local POPs monitoring network in Barbados, which would allow the island to actively participate in the monitoring of POPs and become an active contributor to future effectiveness evaluations of the Stockholm Convention.

It is recommended that projects should be designed, developed and implemented to determine the means by which POPs are being introduced to the Barbadian environment and practicable corrective measures proposed.

9 References

CDB and GOB 2012. Barbados Country Assessment of Living Conditions 2010 Volume I: Human Development Challenges in a Growth Crisis – Addressing Growth and Social Inclusion.

Government of Barbados. (n.d.). Barbados Demographics Profile. Barbados Integrated Government Portal. Retrieved February 1, 2022, from https://www.indexmundi.com/barbados/demographics_profile.html