# NATIONAL IMPLEMENTATION PLAN FOR MANAGEMENT OF POPS IN JAMAICA

2023

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# EXECUTIVE SUMMARY

## INTRODUCTION

The Stockholm Convention on Persistent Organic Pollutants (POPs), the goal of which is the global elimination of chemicals with proven adverse effects and known to be persistent, bioaccumulative and with potential for long-range transport, was adopted in 2001 and entered into force in 2004. Jamaica is a Party to the Convention and, in fulfilment of its obligations under Article 7, produced a National Implementation Plan (NIP) for the management of POPs in 2005. The 2005 NIP addressed the inventory and management of those of the twelve initial POPs listed to the Convention and identified locally. The twelve initial POPs comprise seven chemicals in Annex A only (elimination), one in Annex B only (restriction), two in Annex C only (unintentional production), and two in Annexes A and C. Notably, nine of the initial Annex A and B POPs are pesticides, and two are industrial chemicals with specific and limited applications. Since 2005, 18 more POPs have been added to Annexes A and B of the Convention. Of these new POPs, seven are pesticides only and two have both pesticidal and industrial applications. Most (eleven) of the new POPs are industrial chemicals used as additive flame retardants, or for water repellency, or as plasticizers or surfactants, that are integrated into everyday articles and products such as plastics, electronics, upholstery, carpeting, and firefighting foams. The designation of 18 additional chemicals as POPs under the Stockholm Convention has necessitated a review and update of Jamaica's NIP for POPs.

None of the chemicals that are POPs are manufactured in Jamaica. This updated NIP addresses aspects of the management of the 30 POPs that are imported in products or unintentionally formed. This updated NIP refers frequently to the 2005 NIP, but it is intended to be read as an independent document; salient information from the previous NIP is therefore incorporated.

## COUNTRY PROFILE

Jamaica is an archipelagic state situated in the Caribbean Sea and is one of six countries forming the Greater Antilles. The country, which has a total area of 10,991 km$^2$, is elongated on an east-west axis, and is approximately 145 km south of Cuba and 850 km south of Miami,

Florida. The landform is distinctly mountainous, with narrow coastal plains. Jamaica has a tropical maritime climate with a mean monthly temperature range of 23.0 to 27.1 °C per year and annual mean rainfall of 1773 mm.

The size of the population is approximately 2.7 million with 54% residing in urban areas. Life expectancy is 74.2 years and the literacy rate is 91.7%. The country, which gained independence in 1962, is a former British colony with a history of plantation slavery and indentured immigration. Jamaicans are ethnically 92% black, and English is the official language.

Jamaica is a constitutional monarchy and a member of the Commonwealth. The legislature consists of the Senate (21 appointed senators) and the House of Representatives (63 elected members of parliament, each representing a constituency). The country is divided into 14 administrative units (parishes) with a local government system comprising of Parish Councils or Municipal Corporations.

Jamaica is an upper-middle-income developing economy with a Gross Domestic Product (GDP) per capita of J$ 932,900 (or US$ 6,049.5) in 2022. The country has a mixed free market economy, which is heavily dependent on the services industry (74% of GDP). Environmental issues are centred around water supply, the disposal of wastewater and solid waste, and the management of single-use plastics.

## INSTITUTIONAL, POLICY AND LEGISLATIVE FRAMEWORK

The government departments and agencies with main responsibility for implementation of regulations that bear on POPs management and for coordination of activities under the NIP include the Ministry of Economic Growth and Job Creation (MEGJC), the National Environment and Planning Agency (NEPA), the National Solid Waste Management Authority (NSWMA), the Pesticides Control Authority (PCA), the Standards and Regulation Division (SRD) of the Ministry of Health and Wellness (MOHW) and the Jamaica Customs Agency (JCA). These public sector agencies interact with stakeholders in the private sector and academia.

The current policies and existing legislation relevant to POPs management are as follows:

- National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper)
- National Policy for Environmental Management Systems, 2019

- The Natural Resources Conservation Authority Act, 1991
  - *Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996 and the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development (Amendment) Order, 2015.*
  - *Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations, 2002*
  - *Natural Resources Conservation (Permits and Licences) Regulations, 1996 and The Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015.*
  - *Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013.*
  - *Natural Resources Conservation Authority (Air Quality) Regulations, 2006.*
  - *Natural Resources Conservation (Environmental Protection Measures) Order, 2016*
- The Precursor Chemicals Act, 1999
- The Pesticide Act, 1975
- The National Solid Waste Management Act, 2001 and Regulations
  - National Solid Waste (Public Cleanliness) Regulations 2003

Jamaica is a member of two major regional organizations – the Caribbean Community (CARICOM) and the Organization of American States (OAS). The country is Party to several important multilateral environmental agreements (MEAs). These include the Basel and Rotterdam Conventions, both closely allied to the Stockholm Convention, the Vienna Convention and Montreal Protocol and the Minamata Convention on Mercury, ratified by Jamaica in 2017.

## POPS PRESENT IN JAMAICA

*Pesticides* - The nine pesticides among the twelve initial POPs were prohibited from use in Jamaica in 1999. Of the 18 POPs added to the Convention's list 2009-2019, nine are pesticides, none of which are registered for use in Jamaica: one is restricted and four are prohibited under the Pesticides Act, while the remaining four are not yet regulated. It is recommended that collaboration be undertaken with key MDAs and private entities to ensure the relevant legislation and policies are updated with the four unregulated pesticides. Jamaica's Pesticides Control Authority (PCA) participated in a recently completed regional project for the disposal of obsolete pesticides. Major outcomes of this project were: (a) identification and clean-up of sites contaminated with pesticides; (b) export for destruction in 2017 of 80 t of obsolete pesticides and contaminated materials.

*Polychlorinated Biphenyls (PCBs)* – The main application of PCBs is as dielectric fluid in electrical equipment such as transformers, capacitors, lighting ballasts and some types of cables. PCBs, being among the initial POPs, were subject to inventory for the 2005 NIP, and the total quantity was estimated to be approximately 70 kg. General knowledge (theoretical) of these POPs among stakeholders was therefore fairly good, although disposal practices revealed during some site visits demonstrated poor appreciation of the real implications of improper management of POPs waste. This new PCB inventory entailed interrogation of the PCB status of 28 entities in operation and interviews with personnel from the Jamaica Public Service Company (JPSCo), the main electricity provider. The main findings of the PCB inventory were:

- 18 of these 28 organizations had no major PCB-containing equipment
- PCB-containing equipment and materials were present at ten (10) sites, viz:
  - JPSCo inventory of materials in storage and secured, awaiting export for disposal
  - three transformers at one (1) site containing oil with PCB concentration > 50 ppm
  - paper-insulated lead cables and fluorescent light ballasts at the remaining sites.

From the inventory and information received the minimum total PCBs in transformers, fluorescent light ballasts and mixed waste was estimated to be ca. 18 kg; this is about 26% of the quantity of PCBs reported for Jamaica's 2005 NIP. This reduction is due to the export for disposal of > 389 t of PCB-containing material.

*Brominated Flame Retardants (BFRs)* – Estimates of quantities of brominated flame retardants, the POP-polybrominated diphenyl ethers (POP-PBDEs) were conducted for the EEE/WEEE and transport sectors. Quantities are shown below.

| EEE/WEE SECTOR | |
|---|---|
| *POP-PBDEs imported/year second-hand equipment | 5,501 kg |
| *POP-PBDEs in stockpiled EEE in households and institutions | 6,675 kg |
| *POP-BDEs in casings of CRT monitors and television sets (a subset of above) | 4,147 kg |
| *POP-PBDEs in EEE entering the waste stream annually | 1,108 kg |
| *POP-PBDEs in WEEE exported since June 2018 | 3.8 kg |
| c-DecaBDE content in EEE imported annually<br>*hexaBDE+heptaBDE | 569 kg |

| TRANSPORT SECTOR | |
|---|---|
| (i) †POP-PBDEs in vehicles imported, model years 1975-2004 (total) | 9,009 kg |
| (ii) †POP-PBDEs in 1975-2004 end-of-life vehicles (discarded, scrapped) | 6,626 kg |
| (iii) †POP-PBDEs in vehicles currently in use, model years 1975-2004 | 2,388 kg |
| (iv) †POP-PBDEs in vehicles in used car lots | 2.3 kg |
| †tetraBDE+pentaBDE+hexaBDE+heptaBDE<br>*The sum of (ii)-(iv) is slightly greater than (i)* | |

*Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA)* – This assessment was focused on firefighting foams and synthetic carpets. Awareness of the hazards of these POPs among key stakeholders is low.

- The estimated amount of PFOS/PFOA in the quantities of firefighting foam concentrate reported = 437 kg
- Due to security considerations, large facilities holding foam declined to disclose quantities in stock, although information on brands and products was supplied
- The actual quantity of PFOS/PFOA in all foam concentrate in stock could be as much as 5 x 437 kg
- Estimate of the total quantity of PFOS in synthetic carpets entering the waste stream 1976-2020 = 383 kg
- Estimated quantity of PFOS in synthetic carpets currently in use = 76 kg

*Unintentionally Released POPs (UPOPs)* – A national emissions inventory of UPOPs was carried out using the prescribed methods. Results, shown in the table below, reveal that most UPOPs are released in residue, followed by releases to air and land. The actual quantities calculated (in grams toxic equivalents per year, shown below) are subject to some uncertainty due to insufficient or poor quality data and the necessity for a number of assumptions.

| | Source Groups | Annual Releases (g TEQ/yr) | | | | |
|---|---|---|---|---|---|---|
| Group | | Air | Water | Land | Product | Residue |
| 1 | Waste Incineration | 2.2 | 0.0 | 0.0 | 0.0 | 0.6 |
| 2 | Ferrous and Non-Ferrous Metal Production | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | Heat and Power Generation | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 |
| 4 | Production of Mineral Products | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | Transportation | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | Open Burning Processes | 15.0 | 0.0 | 1.2 | 0.0 | 0.0 |
| 7 | Production of Chemicals and Consumer Goods | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | Miscellaneous | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | Disposal | 0.0 | 0.5 | 0.0 | 0.0 | 229.2 |
| 10 | Identification of Potential Hot-Spots | | | | 0.0 | 0.0 |
| 1-10 | Total | 23 | 0.5 | 1.2 | 0.0 | 230.0 |
| | GRAND TOTAL | 255 | | | | |

*Differences are due to rounding*

## INFORMATION ON STOCKPILES AND CONTAMINATED SITES

*Pesticides* – All known stockpiles of POPs and sites contaminated with POPs pesticides have been cleared and the materials exported for destruction.

*PCBs* – There are no documented PCB-contaminated sites. However, one site at which a transformer oil spill occurred was identified as potentially contaminated. Large, undetermined, quantities of fluorescent light ballasts (FLBs) have been discarded at municipal facilities. Each FLB manufactured before May 1977 contains 10 g PCB fluid.

*Brominated Flame Retardants (BFRs)* – Stockpiles of POP-PBDEs are contained in:

- The EEE stored in households and institutions (6.7 t)
- Polymers in vehicles in use, model years 1975-2004 (2.4 t)

Significant quantities of POP-PBDEs have entered the environment, viz:

- EEE disposed of at municipal facilities annually (1.1 t)
- Disposal of vehicles, model years 1975-2004 (6.6 t)

*Perfluorooctane Sulfonic Acid (PFOS)* – Sites potentially contaminated with PFOS are those at which fire drills using PFOS foam have been conducted, and locations of fires caused by flammable liquids. Municipal disposal facilities are contaminated by the leaching of this water-soluble POP from discarded consumer articles in which it was historically used.

## ENVIRONMENTAL AND BIOMONITORING OF POPS

There are no established local programmes for routine monitoring of levels of POPs chemicals in the environment or to measure the release of UPOPS. Jamaica, however, participated in the GRULAC segment of the Global Monitoring Programmes (GMPs). The results from the GMPs showed that human breast milk samples from Jamaican women contained several POPs pesticides that have not been used locally for several years, as well as the highest levels of PCDD/PCDF in the region. There have also been a small number of academic studies centred on POPs biomonitoring. Levels of POPs in blood and urine of pregnant or delivering women, in one study, and in umbilical cord blood serum of newborns, in a separate study, in Jamaica were found to be similar to or lower than those reported in similar studies in Canada and the United States of America.

Additionally, analysis of POPs in soil and groundwater at possible contaminated sites can be done through testing methods such as bioaccumulation of POPs in aquatic fauna. It should be noted that the Air Quality Management Programme implemented by NEPA monitors some UPOPs, namely those listed under the Natural Resources Conservation Authority (Air Quality) Regulations, 2016.

POPs data within Jamaica can be mapped using the Geographic Information System, by comparing (a) spatial changes to identify hotspots and (b) temporal changes to detect deterioration/improvement occurring in the environment.

## INFORMATION, AWARENESS AND EDUCATION

There appears to be fair knowledge of general POPs issues among senior technical and occupational safety and health professionals in the public and private sectors. Practices revealed during site visits for the PCB assessment point to the need for better training in PCB issues at all levels. Brominated flame retardants and PFOS appear to be unfamiliar topics among relevant stakeholders. Frequent and widespread open burning demonstrates a lack of awareness of UPOPs and the need for a public education campaign. There is no content on POPs in the primary, secondary or tertiary curricula surveyed.

## RELEVANT ACTIVITIES ON NON-GOVERNMENTAL STAKEHOLDERS

Reduction in the quantity of PCBs, 2005-present, is due mainly to exports by the JPSCo (80% privately owned) of PCB-containing equipment, under the company's PCB Management Programme. Limited POPs-related research and monitoring, described previously, takes place at the UWI and other academic institutions.

## TECHNICAL INFRASTRUCTURE FOR POPS ASSESSMENT, MEASUREMENT, ANALYSIS, DISPOSAL, DESTRUCTION

Instrumentation is in place in at least five laboratories for the analysis of most POPS pesticides and PCBs. Three laboratories require inputs of training, standards, and accessories for full capability and two are fully equipped. Dioxins and furans are not analysed; this situation is unchanged since the 2005 NIP. Instrumentation for the determination of POP-PBDEs is not available locally. There is one liquid chromatography triple quadrupole mass spectrometer capable of PFOS/PFOA analysis, but training and standards are needed.

There are no proper hazardous waste landfills in Jamaica, but plans are in place to establish

two sanitary landfills. When managed, hazardous waste that contains POPs is exported for destruction. A privately owned incinerator has been utilized by the PCA for destruction of small quantities of non-POPs obsolete pesticides.

## SYSTEMS FOR LISTING NEW CHEMICALS AND REGULATION OF CHEMICALS ALREADY IN THE MARKET

The PCA maintains a register of pesticides permitted for use, and registration of a new pesticide entails a process of application and technical review. The administrative process for regulating importation of other chemicals and chemical products is managed by the SRD of the MOHW. Regulation of chemicals already in the market is generally driven by obligations under international agreements.

## NATIONAL IMPLEMENTATION PLAN STATUS

Main actions, 2005-present that have advanced Jamaica's compliance with the Stockholm Convention:

- Prohibition of endosulfan in 2011, listed to Annex A in 2011
- Export of PCBs and obsolete pesticides for destruction and reduction of PCBs from 70 kg
- Enactment of new regulations and orders that bear on UPOPs release of POPs from stockpiles and waste
  - *Natural Resources Conservation Authority (Air Quality) Regulations, 2006*
  - *Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015*
  - *Natural Resources Conservation (Environmental Protection Measures) Order, 2016*
  - *Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013*
- Participation in the GRULAC segments of two Global Monitoring Programme cycles, GMP1 (2010-2014) and GMP2 (2015-2019)

## STRATEGY AND ACTION PLAN ELEMENTS

***Priorities***

A. Strengthening of the regulatory and institutional framework for POPs management

B. Public information, awareness and education

C. Control of releases of all POPs by enhancing infrastructure and promoting the use of alternative technologies

D. Upgrade the capacity for monitoring POPs

The estimated cost of implementing the action plan, with a duration of seven years, is **US$5,536,000.**

Details are given in the following table:

| PRIORITY ACTIONS AND NEEDS | Estimated cost (US$) |
|---|---|
| **A. Institutional and Regulatory Strengthening Measures** | |
| PERSONNEL: 10 full-time equivalents (FTEs) over 7 years (mid-level government compensation packages estimated at US$20,000 annually) | **1,400,000** |
| Formalize a coordinating mechanism for POPs management in the public sector | **175,000** |
| Harmonize the roles of the institutions that influence the formation of UPOPs | |
| Legislate the separation of POPs waste from municipal waste | |
| Ensure that legislation in draft is consistent with the provisions of the Stockholm Convention with respect to brominated flame retardants | |
| Ensure that import policies for articles containing POP BFRs are consistent with Stockholm Convention provisions for these chemicals | |
| Harmonize and strengthen the legislation that impacts on generation of UPOPs | |
| Establish a Government database or Clearing House to facilitate the upload of data and information by the relevant public sector agencies to inform, *inter alia*, reporting under Conventions, Protocols and Treaties with appropriate data management oversight | |
| Strengthen border control (operationally) for import of POPs and other hazardous chemicals | |
| Legislate: (a) the prohibition of POPs not currently prohibited; (b) levels of POPs in wastewater, sludge and drinking water | |
| Complete the drafting of the omnibus chemicals legislation and promulgate the Act | |

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| **B. Increasing Public and Stakeholder Awareness, Information and Education** | |
| Raise awareness of POPs issues among policy and decision-makers | |
| Train technical and managerial personnel in specific aspects of POPs management | |
| Develop and implement education and training programmes (primary, secondary and tertiary) at the national and regional levels | |
| Develop a comprehensive public education programme around municipal waste management | |
| Execute the municipal waste management public education programme | **160,000** |
| Develop and disseminate public awareness materials on POPs | |
| Develop and implement, especially for women, children and the least educated, educational and awareness programmes on POPs | |
| **C. Control of releases of all POPs by enhancing infrastructure and use of alternative technologies** | |
| Implement the guidance on BAT/BEP for the use of PFOS/PFOA for exempted uses | |
| Increase collection centres for recyclable plastics, especially in rural townships, to reduce the incidence of plastic burning | |
| Set up community composting projects so that biodegradable waste is put to a useful purpose | |
| Identification and management of stockpiles, waste and articles in use. Including release reduction mechanisms and appropriate measures for handling and disposal | **2,740,000** |
| Education of stakeholders by NEPA and encouraging the use of effective disinfection methods other than chlorination to reduce the formation of UPOPs in Wastewater treatment plants (WWTP) effluent and residues | |

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| Upgrade existing disposal sites to operate as landfills or construct new sanitary landfills | |
| **D. Capacity for monitoring POPs** | |
| Develop the technical capability for analysing PFOS and POP BFRs | **700,000** |
| **SUB-TOTAL FOR PRIORITY ACTIONS & NEEDS** | **5,175,000** |
| **OTHER ACTIONS AND NEEDS** | **Quantified elsewhere (DBJ)**[31] |
| Request and obtain specific exemptions as necessary | **361,000** |
| Reduce or eliminate releases from intentional production and use (HCBD, PCN, SCCP) | |
| Identification, labelling, removal, storage, and disposal of PCBs and equipment containing PCBs | |
| Eliminate import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF and of PFOA | |
| Collection and management of data for UPOPs inventories | |
| Identification of contaminated sites and, where feasible, remediation in an environmentally sound manner* | |
| **SUB-TOTAL FOR OTHER ACTIONS & NEEDS** | **361,000** |
| **GRAND TOTAL** | **5,536,000** |

# ABBREVIATIONS & ACRONYMS

| | |
|---|---|
| **ABS** | acrylonitrile-butadiene-styrene |
| **AAJ** | Airports Authority of Jamaica |
| **ABS** | acrylonitrile-butadiene-styrene |
| **AFFF** | aqueous film forming foam |
| **AGC** | Attorney General's Chambers |
| **APCS** | air pollution control system |
| **AR** | alcohol resistant |
| **ATI** | Access to Information |
| **BAT/BEP** | best available technologies/best environmental practices |
| **BbL** | Barrels of Oil |
| **BFR** | brominated flame retardant |
| **BOE** | Barrels of Oil Equivalent |
| **BRS** | Basel, Rotterdam and Stockholm |
| **CAPE** | Caribbean Advanced Proficiency Examination |
| **CARICOM** | Caribbean Community and Common Market |
| **CASE** | College of Agriculture, Science and Education |
| **CCCL** | Caribbean Cement Company Ltd. |
| **c-OctaBDE** | commercial octabromodiphenyl ether (hexaBDE and heptaBDE) |
| **COP** | Conference of the Parties |
| **c-PentaBDE** | commercial pentabromodiphenylether (tetraBDE and pentaBDE) |

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| **CRT** | cathode ray tube |
| **CSEC** | Caribbean Secondary Education Certificate |
| **CXC** | Caribbean Examinations Council |
| **DBJ** | Development Bank of Jamaica |
| **DecaBDE** | decabromodiphenyl ether |
| **EEE** | electrical and electronic equipment |
| **EHU** | Environmental Health Unit |
| **ELV** | end-of-life vehicle |
| **EPS** | expanded polystyrene |
| **ERMB** | Environment and Risk Management Branch |
| **ESM** | environmentally sound management |
| **EU** | European Union |
| **FAO** | Food and Agriculture Organisation |
| **FFFP** | film forming fluoroprotein foam |
| **FLB** | fluorescent light ballast |
| **FTE** | Full Time Equivalent |
| **GC/MS** | gas chromatography/mass spectrometry |
| **GMP** | Global Monitoring Programme |
| **GRULAC** | Group of Latin American and Caribbean Countries |
| **Ha** | hectares |
| **HAJ** | Housing Agency of Jamaica |
| **HBB** | hexabromobiphenyl |
| **HBCD** | hexabromocyclododecane |
| **HCB** | hexachlorobenzene |

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|---|---|
| **HCBD** | hexachlorobutadiene |
| **HFO** | heavy fuel oil |
| **HIPS** | high impact polystyrene |
| **HR** | Human resources |
| **HS** | Harmonized Commodity Description and Coding Systems |
| **ICENS** | International Centre for Environmental and Nuclear Sciences |
| **IICA** | Inter-American Institute for Cooperation on Agriculture |
| **ITA** | Island Traffic Authority |
| **JBI** | Jamaica Bauxite Institute |
| **JCA** | Jamaica Customs Agency |
| **JCF** | Jamaica Constabulary Force |
| **JDF** | Jamaica Defence Force |
| **JIS** | Jamaica Information Service |
| **JPSCo** | Jamaica Public Service Company |
| **JUCDA** | Jamaica Used Car Dealers' Association |
| **LCD** | liquid crystal display |
| **LPG** | liquefied petroleum gas |
| **MDAs** | Ministries, Departments and Agencies |
| **MEA** | Multilateral environmental agreement |
| **MEGJC** | Ministry of Economic Growth and Job Creation |
| **MFAFT** | Ministry of Foreign Affairs and Foreign Trade |
| **MLGRD** | Ministry of Local Government and Rural Development |
| **MOAF** | Ministry of Agriculture and Fisheries |

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| **MOHW** | Ministry of Health and Wellness |
| **MOJ** | Ministry of Justice |
| **MOU** | Memorandum of understanding |
| **MPM** | Metropolitan Parks and Markets Waste Management |
| **MSET** | Ministry of Science, Energy and Technology |
| **MTM** | Ministry of Transport and Mining |
| **NCRA** | National Compliance & Regulatory Authority |
| **NCT** | National Coordinating Team |
| **NEPA** | National Environment and Planning Agency |
| **NEPM** | North Eastern Parks and Markets Waste Management |
| **NERHA** | Northeast Regional Health Authority |
| **NGO(s)** | non-governmental organization(s) |
| **NIP** | National implementation plan |
| **NRCA** | Natural Resources Conservation Authority |
| **NSWMA** | National Solid Waste Management Authority |
| **NWC** | National Water Commission |
| **OPC** | Office of the Parliamentary Counsel |
| **PCA** | Pesticides Control Authority |
| **PCB(s)** | polychlorinated biphenyl(s) |
| **PCDD** | polychlorinated dibenzo-p-dioxins |
| **PCDF** | polychlorinated dibenzofurans |
| **PCN(s)** | Polychlorinated naphthalene(s) |

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|---|---|
| **PeCBz** | pentachlorobenzene |
| **PEP** | Primary Exit Profile |
| **PFAS** | Perfluorinated alkyl substances |
| **PFOA** | Perfluorooctanoic acid |
| **PFOS** | Perfluorooctane sulfonic acid |
| **PILC** | paper insulated lead cables |
| **PIOJ** | Planning Institute of Jamaica |
| **POP(s)** | persistent organic pollutant(s) |
| **POP-PBDEs** | POP-polybrominated diphenyl ethers (listed PBDEs) |
| **ppm** | Parts per million |
| **PVC** | polyvinyl chloride |
| **RADA** | Rural Agricultural Development Authority |
| **SC** | Stockholm Convention |
| **SCCP** | short-chain chlorinated paraffins |
| **SDS** | safety data sheet |
| **SERHA** | Southeast Regional Health Authority |
| **SIA** | Sugar Industry Authority |
| **SIRI** | Sugar Industry Research Institute |
| **SDC** | Social Development Commission |
| **SPM** | Southern Parks and Markets Waste Management |
| **SRD** | Standards and Regulation Division |
| **STATIN** | Statistical Institute of Jamaica |
| **STP** | Sewage treatment plant |

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|---|---|
| **TLI(s)** | Tertiary Level Institution(s) |
| **TV** | television |
| **UK** | United Kingdom |
| **UPOP(s)** | Unintentional Persistent Organic Pollutant(s) |
| **USA** | United States of America |
| **UTECH** | University of Technology, Jamaica |
| **UWI** | University of the West Indies |
| **WEEE** | waste electrical and electronic equipment |
| **WPM** | Western Parks and Markets Waste Management |
| **WRA** | Water Resources Authority |
| **WWTP** | Waste water treatment plant |
| **XPS** | extruded polystyrene |

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# INTRODUCTION

## 1.1 THE STOCKHOLM CONVENTION

The Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted in 2001 and entered into force in 2004.[1] The goal is the protection of human health and the environment by global elimination of chemicals proven to have adverse effects, be persistent, to bioaccumulate, and with potential for long-range transport. Currently, there are 186 Parties to the Convention. The Convention was signed by Jamaica in 2001 and ratified in 2007.

## 1.2 THE POPS

Chemicals or mixtures of chemicals designated as POPs under the Convention are divided into three groups.

- Annex A (for elimination)
- Annex B (for restriction)
- Annex C (formed unintentionally, and which Parties must reduce or eliminate)

Annex A and Annex B chemicals may also be listed in Annex C.

Initially, the Convention targeted twelve chemicals (initial POPs, known as the "dirty dozen") – nine pesticides, one industrial chemical group (polychlorinated biphenyls, PCBs) and two unintentionally formed substances (unintentional POPs, UPOPs). Currently, there are 30 POPs listed to the Convention, classified as follows:

- 26 substances are placed in Annex A (for elimination)
- two are listed in Annex B (for restricted use)
- seven POPs are listed in Annex C (unintentional release, known as UPOPs) – five of these seven chemicals are also listed in Annex A

For some discussions it is useful to classify POPs by application or origin, viz:

- 15 POPs are pesticides, exclusively
- three POPs are both pesticides and industrial chemicals
- ten POPs are industrial chemicals, exclusively
- two POPs are formed by unintentional release only

The following POP industrial chemicals are of particular concern because of their wide, and in some cases, dispersive, applications.

- *polychlorinated biphenyls* – *P*CBs, listed as one POP in Annex A (an initial POP); PCBs were widely used up to ca. 1980 as dielectric fluids in heavy-duty transformers and capacitors
- *brominated flame retardants* – BFRs, five chemicals, listed in Annex A after 2009; additives to polystyrene foam, and to plastics used in electronic equipment and motor vehicles, and to textiles
- *perfluoroalkyl substances* – PFAS, two chemicals, one listed in Annex A and one in Annex B, both after 2009; used in firefighting foams and as water and grease repellent agents in textiles and packaging

Unintentionally formed POPs (UPOPs) are generated mainly by thermal processes (industrial activities and operation of motor vehicles) or combustion (deliberately set or accidental fires) and are released to air, water (surface and ground) and land (surface and soil).

Most (eleven) of the recent POPs are industrial chemicals that are integrated into everyday articles and products. This has far-reaching implications for generating inventories, elimination, management of waste, and recycling activities. A list of the POPs, the years in which they were listed to the Convention, and major applications are provided in Table 1.1. More detailed information on the chemicals is given in Annex 1.

## 1.3 OBLIGATIONS UNDER THE STOCKHOLM CONVENTION

Parties to the Convention have several obligations. They must take action to eliminate the production, use, import, and export of intentionally produced POPs and to manage stockpiles and wastes containing these chemicals so that releases to the environment are minimized. For unintentionally produced POPs, measures should be taken to reduce and, if possible, eliminate releases from anthropogenic sources. Each Party must promote and facilitate public information, awareness, and education about POPs.

A critical requirement (Article 7) is the development of a plan, the National Implementation Plan (NIP), for the implementation of all obligations under the Convention, and to periodically review and update the NIP. For Parties to the Convention, the NIP is one element of the national policy framework for environmental protection and management of chemicals and hazardous waste. Progress in addressing POPs issues is monitored against baseline information incorporated into versions of the NIP. Parties must report on measures taken to implement the provisions of the Convention.

## 1.4 BACKGROUND TO THE NATIONAL IMPLEMENTATION PLAN

Jamaica's first NIP was published in 2005.[2] It addressed the inventory and management of those of the twelve initial POPs listed to the Convention and identified locally. The listing of 18 additional chemicals to the Convention since 2009 has necessitated a review and update of Jamaica's NIP. This updated NIP addresses aspects of the management of the 30 POPs that are imported in products or are unintentionally formed. The updated NIP refers frequently to the 2005 NIP, but it is intended to be read as an independent document; salient information from the previous NIP is therefore incorporated.

## 1.5 THE APPROACH TO THE REVIEW AND UPDATE OF THE NATIONAL IMPLEMENTATION PLAN

Production of the updated NIP proceeded through the five phases recommended in the UNEP guidance document.[3]

In phase I, a National Coordinating Team (NCT) consisting of representatives of public sector entities with roles in management of POPs and academic institutions was assembled to oversee the work of three consultants engaged to execute the project. The NCT was led by the Ministry of Economic Growth and Job Creation (MEGJC), the technical focal point of the Stockholm Convention.

The outcomes of activities in phase II were the inventories of POPs and an overview of the institutional, policy and legislative framework for management of POPs. The assessments of PCBs, UPOPs, brominated flame retardants (BFRs) and perfluorooctane sulfonic acid (PFOS) were each preceded by a stakeholder consultation session, held virtually due to Covid-19 pandemic constraints. Participants comprised of private sector users of the respective POPs-containing articles and products, representatives of relevant public sector entities and members

of the NCT. Each session consisted of a short presentation with information on; the Stockholm Convention and POPs, the occurrence and adverse effects of the subject POPs, an overview of the local situation, the proposed inventory, and the need for stakeholder support and engagement. Short quizzes on the knowledge of POPs were administered.

Recent activities, described in later sections of the NIP, obviated the need for a detailed inventory of POPs pesticides. Assessment of the current local situation was therefore based on a desk study, import statistics, discussions with the Registrars (present and past) and senior officials of the Pesticides Control Authority (PCA), and a review of the annual reports of the PCA.

The PCB assessment is based largely on:

a. information obtained from the Jamaica Public Service Company (JPSCo), the primary electrical utility company;
b. interrogation of the PCB status of 28 holders of electrical equipment, some of which generate electricity for supply to the national grid.

The inventory of brominated flame retardants in the transport sector used import data on vehicles provided by the Jamaica Customs Agency (JCA), vehicle registration numbers from the Ministry of Transport and Mining (MTM) and other information supplied by Jamaica Used Car Dealers Association (JUCDA) and the National Solid Waste Management Authority (NSWMA). Estimates of BFRs in vehicles (model years 1975-2004) imported to Jamaica were obtained by computations using the local data and the literature values and methods in the relevant United Nations Environment Programme (UNEP) guidance document.[4] The inventories of BFRs in the electrical and electronic equipment (EEE) and waste electrical and electronic equipment (WEEE) sectors also used values and methods from this document, with local information comprising data from STATIN, JCA (import data), NSWMA (EEE in waste) and NEPA (exported WEEE) as well as results of limited surveys of EEE stockpiled by householders and institutional and corporate consumers.

The primary focus of the perfluorooctane sulfonic acid (PFOS) (and perfluorooctanoic acid – PFOA) inventory was firefighting foams. Conclusions were based on responses to a questionnaire adapted from the UNEP guidance document for PFOS inventories[5] and administered to personnel in entities with firefighting capability. Quantities of PFOS in synthetic carpets in use and in waste were estimated using import statistics (STATIN) and literature data on concentrations.[6]

For the UPOPs inventory, data was collected from public sector agencies and private companies. Key public sector sources were the National Environment and Planning Agency (NEPA) – the main environmental regulator, the Statistical Institute of Jamaica (STATIN), the Ministry of Science, Energy and Technology (MSET), the Island Traffic Authority (ITA), the National Water Commission (NWC) and the Ministry of Health and Wellness (MOHW). The estimates of emissions of polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) were calculated using the data collected (activity values) and emission factors from the applicable sources published in the UNEP document,[7] and incorporated in the associated spreadsheet.

**Table 1.1: POPs, their year of listing into the Convention, and major applications**
**Annex A – elimination; Annex B – restriction; Annex C – unintentional production**
**P – pesticide; IC – industrial chemical; UP – unintentional production**

| Annex | Year | Name | P | IC* | UP† | *Important applications/†sources |
|---|---|---|---|---|---|---|
| A | Initial POPs | Aldrin | ✓ | | | |
| | | Chlordane | ✓ | | | |
| | | Dieldrin | ✓ | | | |
| | | Endrin | ✓ | | | |
| | | Heptachlor | ✓ | | | |
| | | Hexachlorobenzene (HCB) | ✓ | ✓ | | Manufacturing intermediate |
| | | Mirex | ✓ | | | |
| | | Polychlorinated biphenyls (PCB) | | ✓ | | Heat exchange fluids in transformers & capacitors; carbonless copy paper; paint; plastics |
| | | Toxaphene | ✓ | | | |

| Annex | Year | Name | P | IC* | UP† | *Important applications/†-sources |
|---|---|---|---|---|---|---|
| A | 2009 | Alpha hexachlorocyclohexane (α-HCH) | ✓ | | | |
| | | Beta hexachlorocyclohexane (ß-HCH) | ✓ | | | |
| | | Chlordecone | ✓ | | | |
| | | Hexabromobiphenyl | | ✓ | | Flame retardant in synthetic fibres & plastics |
| | | Hexabromodiphenyl ether & heptabromodiphenyl ether | | ✓ | | Flame retardant used mainly in plastics for housing of office & electronic equipment |
| | | Lindane | ✓ | | | |
| | | Pentachlorobenzene (PeCB) | ✓ | ✓ | | Flame retardant; used with PCBs in dielectric fluids |
| | | Tetrabromodiphenyl ether & pentabromodiphenyl ether | | ✓ | | Flame retardant in polyurethane foams & elastomers used in upholstery |
| | 2011 | Technical endosulfan & related isomers | ✓ | | | |
| | 2013 | Hexabromocyclododecane (HBCD) | | ✓ | | Flame retardant in textiles & in expanded & extruded polystyrene used in buildings, vehicles, electronic equipment |
| | 2015 | Hexachlorobutadiene (HCBD) | | ✓ | | Dielectric/heat transfer liquid; manufacturing intermediate |
| | | Pentachlorophenol, its salts & esters | ✓ | | | |
| | | Polychlorinated naphthalenes (PCNs) | | ✓ | | Capacitor dielectrics |
| | 2017 | Decabromodiphenyl ether (c-de-caBDE | | ✓ | | Flame retardant in plastics used in vehicles & electronics & in commercial textiles |
| | | Short-chain chlorinated paraffins (SCCPs) | | ✓ | | Flame retardant in rubber & textiles; leather processing; paints |
| | 2019 | Dicofol | ✓ | | | |
| | | Perfluorooctanoic acid (PFOA), its salts & PFOA-related compounds | | ✓ | | Firefighting foam, leather, apparel, textiles, upholstery, paper, packaging, paints, inks; closed use in semiconductor & photographic industries |

| Annex | Year | Name | P | IC* | UP† | *Important applications/†-sources |
|---|---|---|---|---|---|---|
| B | Initial POP | DDT | ✓ | | | |
| | 2009 | Perfluorooctane sulfonic acid (PFOS), its salts, & per-fluorooctane sulfonyl fluoride | ✓ | ✓ | | Firefighting foam, aviation hydraulic fluid, synthetic carpets, leather, apparel, textiles, upholstery paper, packaging, coating additives, paints, inks; closed use in electronics, semiconductor, photographic & metal plating industries |
| C | Initial POPs | Polychlorinated dibenzo-p-dioxins (PCDD) | | | ✓ | Waste incineration, trash burning |
| | | Polychlorinated dibenzo-furans (PCDF) | | | ✓ | Waste incineration, trash burning |
| | | Hexachlorobenzene (HCB) | | | ✓ | Waste incineration |
| | | Polychlorinated biphenyls (PCB) | | | ✓ | Waste incineration |
| | 2009 | Pentachlorobenzene (PeCB) | | | ✓ | Waste incineration; activated sludge from wastewater treatment |
| | 2015 | Polychlorinated naphthaleneslenes (PCNs) | | | ✓ | Waste incineration |
| | 2017 | Hexachlorobutadiene (HCBD | | | ✓ | Formed during production of chlorinated hydrocarbons |

Phase II culminated in a "Capacity Building Workshop" targeted to all who had supplied information for the inventories and members of the NCT. The findings of the inventories were presented at this workshop and possible measures for reducing and eliminating each group of POPs, or for mitigating their effects, were discussed. Priorities for action plans for management of categories of POPs were set by the NCT, and this exercise constituted phase III of the NIP development. In phase IV, reduction, disposal and destruction options for POPs and POPs-containing articles were identified and assessed, and road maps for environmentally sound management and cost estimates for implementation were produced. These elements were consolidated into a report comprising the updated strategy and detailed action plans to reduce POPs in Jamaica. The inventories and action plans formed the basis of the draft NIP, production of which signalled the end of phase IV of the process. Phase V consisted of the validation workshop for the draft NIP and the finalization of the document.

## 1.6 MAINSTREAMING GENDER IN THE NATIONAL IMPLEMENTATION PLAN FOR POPS

Gender mainstreaming is a global strategy that is used to achieve gender equality by integrating a gender perspective – that is, to look at and examine the impact of gender on people's opportunities, social roles and interactions. The adoption and use of the strategy require the integration of a gender perspective in all aspects of the process, namely, the planning, design, implementation, monitoring and evaluation of policies, regulatory measures and programmes. Gender mainstreaming is intended to promote equality between men and women by identifying and treating with the factors and events that negatively impact their equality. POPs affect women and men differently and the steps taken to identify and treat with the respective outcomes should be carried out without bias to either sex.

The management evaluation criteria must include information on the number of men and women across the various industries in relation to their placement and roles, risk, health issues, POPs accidents and the interventions undertaken. The general profile of the health status of the men and women at risk for POPs must be determined and the interventions should be integrated with the measures to reduce or eliminate them.

Gender mainstreaming requires that the identified steps for the NIP for POPs include clarification of the following matters: the issues and goals inclusive of gender and the related human biological concerns; the stakeholders; mapping of the issues based on the available information to enable the identification of additional information and action to refine the issues. This initial mapping is also useful to show process and activity, identify risks, show compliance and provide evidence for training and change. The foregoing is essential to develop and focus the policy objectives and the required interventions to reduce or eliminate the harmful effects of POPs on men and women while advancing the safety and productivity of the industries.

Gender mainstreaming provides the platform for gender analysis which is the process by which the required data and information are obtained to enable the integration of a gender perspective into policies and programmes. To conduct a gender analysis of the impact of POPs baseline, a basic requirement is sex-disaggregated data, that is, the number of males and females. Additionally, the demographic and health data needed for analysis must include age, job responsibility/ occupation, status and length of employment, education and training, area of residence, health conditions etc. POPs data should include details of their chemical composition, likely harmful effects, where and how they are utilized, by whom indicating their sex, provision and availability of POP information and education, guidelines for their use and their enforcement, availability and use of protective gear, the occurrence of incidents and the

related response and outcome. The scope and detail of the data and information should be guided by the objectives and the mapping exercise. An integrative analysis of the data for employees and POPs should provide valuable insight to guide policy, identify needed safety, health and gender-specific measures, barriers and constraints and a research agenda for the industries.

It is sometimes difficult to grasp the importance of gender mainstreaming and analysis in technical areas. Its importance lies in the need to first understand the impact of any plan or activity on the people involved. The conduct of a comprehensive gender analysis of the industries using POPs will facilitate the development of interventions to address the unequal treatment and response to health and other issues that affect women and men differently thereby making way for a safe and productive labour force.

# 2

# COUNTRY BASELINE

## 2.1 COUNTRY PROFILE

### 2.1.1 GEOGRAPHY, GEOLOGY AND CLIMATE

Jamaica is an archipelagic state forming one of six countries of the Greater Antilles (Figure 1). The Greater Antilles and the Lesser Antilles form a larger archipelago. This island chain and other isolated island groups comprise the Caribbean Islands, also called the West Indies. The land mass of Jamaica is situated in the Caribbean Sea, approximately 145 km south of Cuba and 850 km south of Miami, Florida. It is centred at coordinates 18°15′N 77°30′W and has an area of 10,911 km$^2$. This area is divided into three counties, namely, Cornwall, Middlesex and Surrey. There is further subdivision into parishes, which are the smallest units of local government. There are fourteen parishes, of which Kingston is the capital. North-east of the capital is the highest point in Jamaica (2556 m) – the Blue Mountain Peak, a UNESCO World Heritage Site.


**Figure 1: Political map of Jamaica**

The landform of Jamaica is markedly mountainous. The island sits on the north-western part of the Caribbean Plate. One of the main topographical features is an elevated limestone plateau which envelops the interior mountains and ends towards the sea.

The White Limestone Group (Figure 2) accounts for about two-thirds of exposed rocks on the island of Jamaica.[8] These rocks form the typical karst plateau terrain of the island and host the bauxite deposits.[8] The White Limestone contains pure carbonates (limestones and dolostones) and spreads over the surface of the rocks of the Yellow Limestone Group.[8] The Yellow Limestone

Group contains pure limestone, impure limestones and a range of clastic rocks (mudstones, shales, sandstones and conglomerates).[8] The Cretaceous rocks include island-arc volcanic, volcaniclastics, limestones, and high- and low-grade metamorphics.[8]

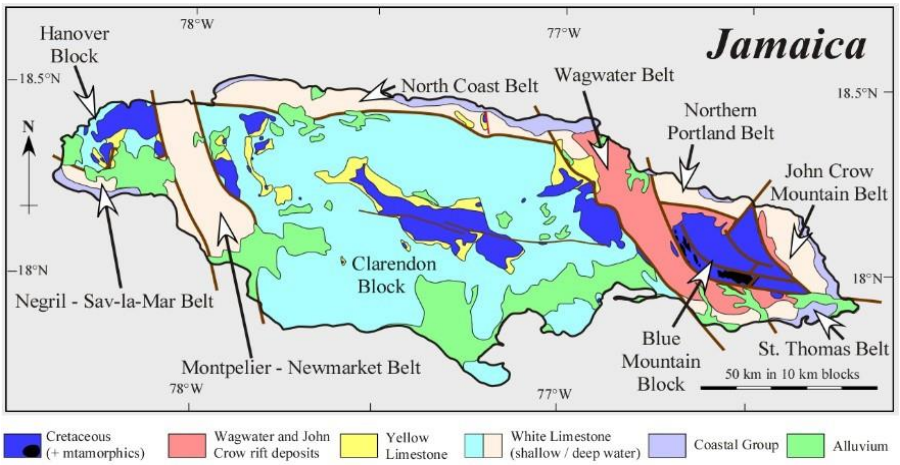



**Figure 2: Geological map of Jamaica**
(Source: SFM Geology, http://www.sfmgeology.com/, (Accessed April 2021)

Jamaica has a tropical maritime climate. The mean monthly temperatures range from 23.0 to 27.1 °C per year.[9] For the summer months, the average maximum temperatures can be as high as 31 °C and the average minimum can fall to 18.4 °C during the period December to March.[9] The island experiences two wet and two dry seasons. The wet seasons are April to June and September to November while the two dry seasons are July to August and December to March.[9] Rainfall varies monthly and annually with a 30-year (1971-2000) mean of 1773mm.[10] In 2022, the country experienced 1674mm[11] or approximately 94% of normal rainfall. Rainfall is the main climatological variable that influences temperature, humidity, sunshine and evaporation. Systems such as hurricanes (tropical cyclones), tropical waves, tropical depressions and tropical storms occur from June to November, and relative humidity is high throughout the year. Other climatic influences are the northeast trade winds, which interact with the mountain ranges along the east-west axis and the Caribbean Sea, synoptic weather systems - primarily the Azores-Bermuda high-pressure system, surface, mid and upper-level troughs and frontal systems.

### 2.1.2 POPULATION, ETHNICITY, LANGUAGE, LITERACY AND EDUCATION

For 2022, the population was estimated at 2,738,100 with 54% living in urban areas.[11] The gender split was 49.5% males and 50.5% females.[11] National statistics for the year indicated that the number of births and deaths recorded were 31,300 and 21,400 respectively resulting in a natural population increase of 9,900 persons.[11] Emigration accounted for a loss of 18,000 persons[11]. For the same year, life expectancy at birth was 74.2 years and changes in the population included a declining

child population (0-14 years) and increasing working age (15 – 64 years) and elderly (65+ years) populations.[11] With the country's history of plantation slavery and indentured immigration, the population of Jamaica is 92% black, 6% mixed race, and 2% other groups, which include Indians, Europeans and Chinese.[12]

Being a former British colony, the official language of Jamaica is English. English is therefore the language of instruction in schools and the medium of most formal communication. Informally, however, the people speak the English-based Jamaican creole language. In 2022, the literacy rate was 91.7%.[11] For the year, 52,500 Jamaicans were enrolled in tertiary institutions, 197,400 in secondary institutions and 195,100 at the primary level.[11]

### 2.1.3 POLITICAL PROFILE

In Jamaica, the system of governance is a constitutional monarchy or limited monarchy. The King of England, Charles III, represented by a Governor-General, is the titular head of state. The Executive, Legislature and Judiciary form the three arms of government (Figure 3).

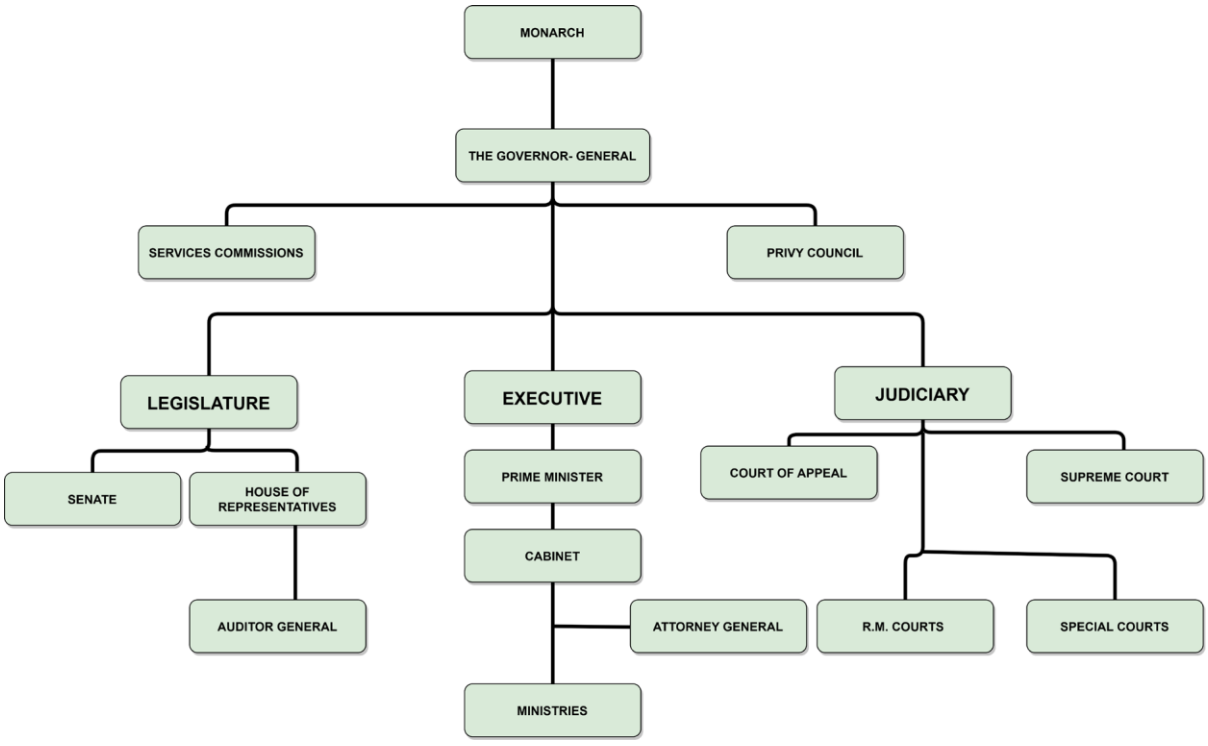



**Figure 3: Jamaica's system of governance**

The Jamaican constitution is modelled on the British Westminster-Whitehall system of government. The citizens, therefore, through universal adult suffrage gained in 1944, have the right to participate in elections and choose the officials that govern the country. Jamaica had a long history of British colonization from the 1650s until 1962 when it became independent. In 2022, the Government established the Ministry of Legal and Constitutional Affairs with a mandate to spearhead constitutional reform. The goals of the Ministry include the development of a new constitution and the establishment of a parliamentary republic.

Jamaica's 14 parishes are subdivided into 63 constituencies. In accordance with the Westminster system, 63 Members of Parliament (MPs) are elected to the Jamaica House of Representatives. The senate comprises 21 senators appointed by the Governor General on advice of the Prime Minister (13) and the Leader of the Opposition (8).

The Municipal Corporations (Local Authorities) are empowered to make by-laws, regulations and rules for the governance of their respective parishes. Local Authorities are those units at the local level through which the Ministry of Local Government and Community Development carries out its functions within communities. These units are the Kingston and St. Andrew Municipal Corporation (KSAMC), the Municipality of Portmore and twelve Parish Councils.

### 2.1.4 ECONOMIC PROFILE

Jamaica is an upper middle-income country with a Gross Domestic Product (GDP) per capita (at current market prices) in 2022 of J$ 932,900 (or US$ 6,049.5).[11] The economy is heavily dependent on services, which accounted for 74% of GDP in 2022 (Figure 4). Other industries include manufacturing (9.0%), agriculture, forestry and fishing (8.3%), construction (7.6%) and mining and quarrying (1.0%).[11] For 2022, Jamaica recorded higher trade values when compared to the previous year, with export earnings and the cost of imports increasing by 28.4% and 29.5% respectively.[11] Total imports were valued at US$ 7,731.2 million and exports totalled US$ 1,901.4 million resulting in a widening trade deficit of US$ 5,829.8 million[11] (Figure 5).

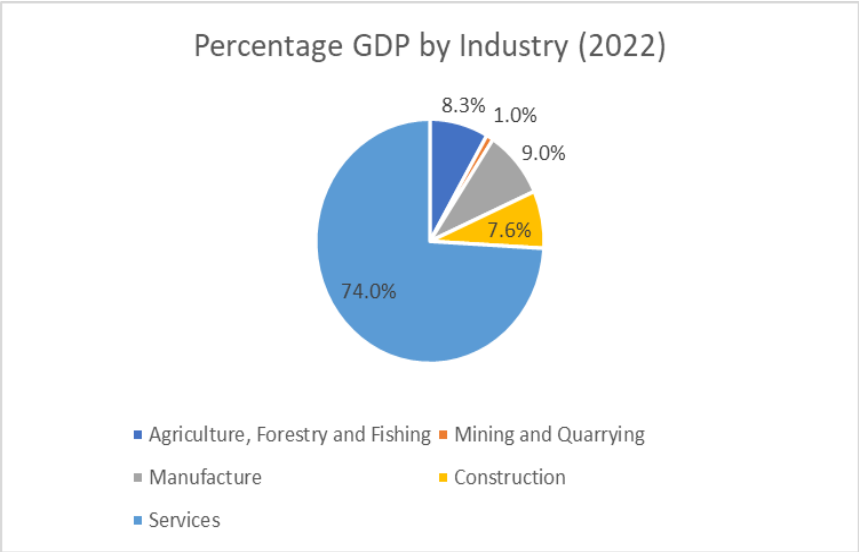



**Figure 4: Percentage GDP by industry (2022)**

(Data Source: Planning Institute of Jamaica)

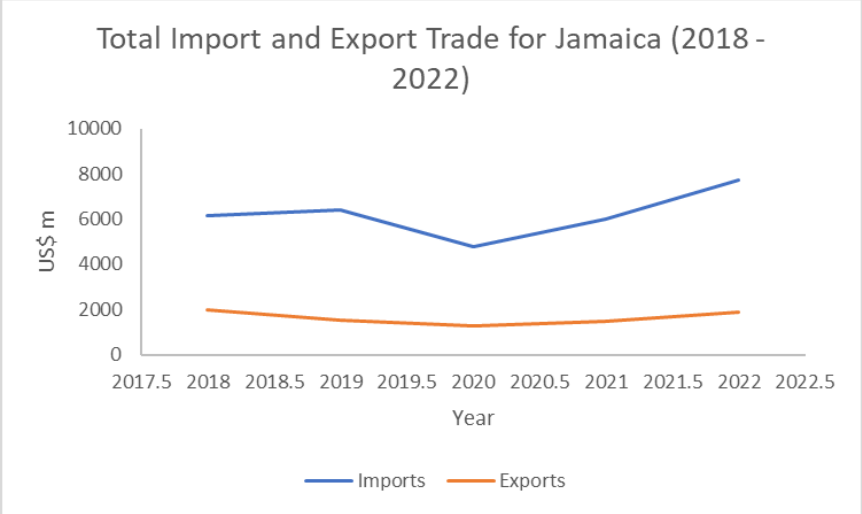



**Figure 5: Total import and export trade (2018 – 2022)**

(Data Source: Planning Institute of Jamaica)

Growth in GDP fluctuated during the period 2018 to 2022, moving from 1.9% in 2018 to -9.9% in 2020 to 5.2% in 2022[11] (Figure 6). During the same period, annual average inflation increased from 3.7% in 2018 to 10.4% in 2022[11] (Figure 7).


**Figure 6: Growth in GDP (2018-2022)**

(Data Source: Planning Institute of Jamaica)

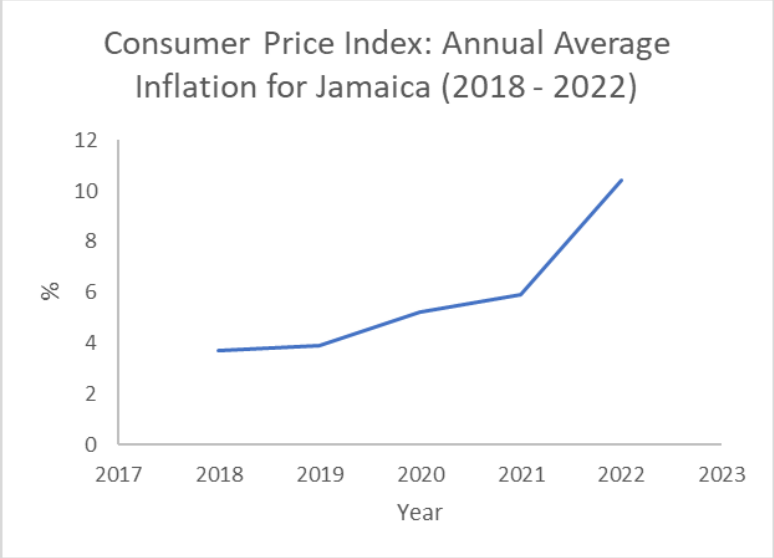



**Figure 7: Annual average inflation (2018 – 2022)**

(Data Source: Planning Institute of Jamaica)

The labour force in 2022 was 1,357,700 or approximately 50% of Jamaica's population.[11] During the period 2018 to 2023, there was a spike in unemployment in 2020 but overall, there was a general decline in the unemployment rate (Figure 8). In 2018, the rate was 9.1% and it increased to 10.2% in 2020 before trending downwards to 6.6% and 4.5% in 2022 and 2023 respectively.[11, 32]

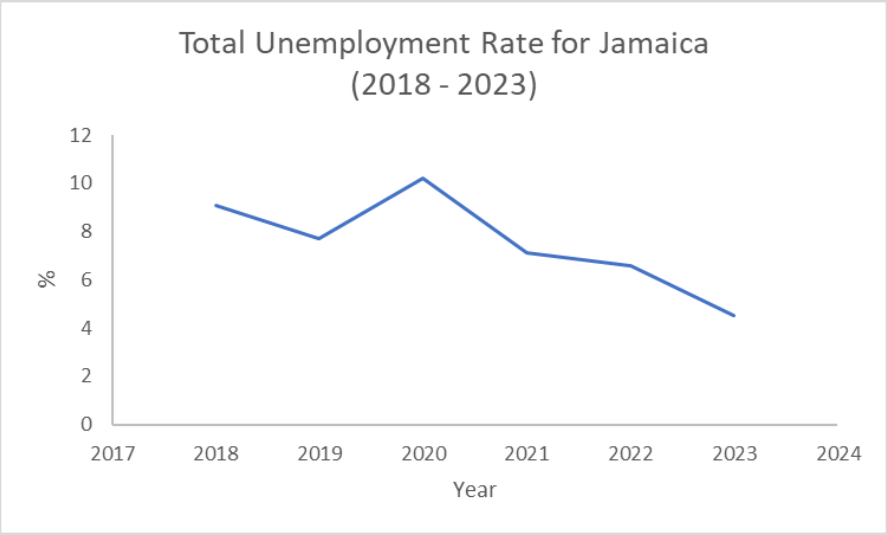



**Figure 8: Unemployment rate (2018 – 2023)**

(Data Sources: Planning Institute of Jamaica and Statistical Institute of Jamaica)

### 2.1.5 AIRPORTS AND SEAPORTS

International trade is facilitated through airports and seaports. There are three international airports in Jamaica – Sangster International Airport in the western city of Montego Bay, Norman Manley International Airport on the outskirts of the capital, Kingston, and the Ian Fleming International Airport in Boscobel, St. Mary. There are two terminals for container handling, located in Kingston and Montego Bay. The Port of Montego Bay is primarily focused on domestic cargo and bulk fuel. The Kingston Freeport Terminal, at the Port of Kingston, predominantly handles transhipment cargo. The Port of Kingston is located between the east-west and north-south trade routes. Additionally, there are five cruise ship terminals located at the Ports of Montego Bay, Falmouth, Port Royal, Ocho Rios and Port Antonio.

### 2.1.6 ENVIRONMENTAL CONDITIONS AND ISSUES

*Sanitation* – The National Water Commission (NWC), a statutory body, provides potable water and sewerage services to the Jamaican population. Approximately 70% of the population accesses water from the NWC through house connections with the other 30% using standpipes, water trucks, community tanks, rainwater systems and water directly from rivers and streams[13]. A major challenge for the water utility is maintaining a reliable supply in a

changing climate. Regarding sewerage operations, the NWC only serves around 30% of the population[13]. The remaining populace uses various types of on-site systems including soak-away pits and pit latrines. These systems negatively impact groundwater resources.

*Waste Disposal:* Jamaicans generate about 1 kg per day of solid waste per person and approximately 70% is collected by the National Solid Waste Management Authority (NSWMA).[11] There are eight municipal disposal sites managed by the NSWMA. These facilities are located in Portland, St. Ann (two), Kingston & St. Andrew, St. Thomas, St. James, St. Elizabeth and Manchester. During the twelve-month period, April 2021 to March 2022, a total of 1,047,822 tonnes of solid waste were collected for disposal at the various sites.[14] Major issues for the waste sector include burning and indiscriminate dumping, which negatively impact public and environmental health.

*Plastic Waste* - Plastics make up around 15% of solid waste generated making it the second most collected waste material in Jamaica.[32] Plastics that are not disposed of at NSWMA sites or collection centres for recycling end up in drains, rivers, gullies, beaches and eventually the ocean. Measures taken to address the management of plastics and the problem of disposal include:

- plastic separation and recycling initiatives spearheaded by the NSWMA;
- recycling facilitated by Recycling Partners of Jamaica;
- Government's three-phase ban, implemented between 2019 and 2021, on importation, manufacture, distribution and use of categories of plastic bags, Styrofoam and drinking straws; and
- the Kingston Harbour Clean-up Project.

## 2.2 INSTITUTIONAL, POLICY, AND REGULATORY FRAMEWORK

**The Constitution of Jamaica or The Charter of Fundamental Rights and Freedoms (Constitutional Amendment) Act, 2011**

The Constitution of Jamaica was amended in 2011 with the enactment of The Charter of Fundamental Rights and Freedoms (Constitutional Amendment) Act, 2011. The relevant feature of this amendment is the inclusion of an environmental right as a constitutional right, viz. "The right to enjoy a healthy and productive environment free from the threat of injury or damage from environmental abuse and degradation of the ecological heritage."

### 2.2.1 POLICIES AND GUIDELINES THAT ADDRESS POPs ISSUES

There are a number of policies and guidelines that relate to POPs management. These include the National Policy for the Environmentally Sound Management of Hazardous Wastes, the National Policy for Environmental Management Systems, 2019, the Motor Vehicle Importation

Policy, 2014, and the Emissions Policy Framework for Jamaica, 2023.

#### 2.2.1.1 National Policy for the Environmentally Sound Management of Hazardous Wastes

This policy is the most recent and most comprehensive assessment of the hazardous waste management situation in Jamaica. The first stated objective is the establishment of effective hazardous waste management frameworks at all levels. Other objectives relate to information sharing and raising awareness, and promotion of funding mechanisms. Aspects of this policy specifically address POPs-containing waste and are directly relevant to the implementation of the Stockholm Convention.

- POPs chemicals are listed among the categories of hazardous waste identified for priority attention in the short to medium term.
- Development of a management plan for speedy elimination of PCB-containing electrical equipment in the transmission and distribution systems and updating of the PCB Management Guideline are proposed as short/medium-term policy implementation actions.

The policy outlines an implementation roadmap that will focus on priority hazardous wastes within the short to medium term, and which includes POPs. The policy will guide the development of drafting instructions for legislation directly focused on the management of hazardous waste including POPs.

#### 2.2.1.2 National Policy for Environmental Management Systems, 2019

The stated goal of this policy is to guide and promote the implementation of Environmental Management Systems (EMS) in the public and private sectors. The first listed strategy is the strengthening of the legislative framework for environmental regulation. Proposals for new or amended legislation resulting from updating the National Implementation Plan (NIP) for POPs would be in line with this policy – specifically the second outcome indicator of policy strategy 1.1 "environmental policies and regulations updated" and with the currency of the policy (March 2019).

#### 2.2.1.3 Motor Vehicle Importation Policy, 2014

Large numbers of used motor vehicles are imported to Jamaica annually, mainly from Japan. The maximum allowable age of vehicles for import in each category (cars, motorcycles, trucks of various sizes, special purpose vehicles) is regulated under this policy. Brominated flame retardants (BFRs) that are POPs chemicals have been widely used in the materials (plastics, foams, textiles) from which motor vehicle components are fabricated. Although the use of some POPs BFRs have been discontinued, adherence to the vehicle age guidelines in this policy can contribute significantly to reducing the quantities of POPs-containing materials that end up in the waste stream. Ideally, used vehicles coming into the island should be regulated so that the allowable ages (currently 20-30 years for larger buses and all trucks) do not exceed the years of cessation (in 2023, 16 years for most POP-PBDEs) of the use of these chemicals.

#### 2.2.1.4 Emissions Policy Framework for Jamaica

This policy is in preparation. The policy will address the management of emissions from

- Industrial processes and power generation
- Land, air, and sea transportation
- Waste disposal and treatment
- Land use and biomass burning
- Agricultural by-products
- Residential and commercial sources

The list above covers all the source categories that are assessed for the production of UPOPs in generating these inventories.

### 2.2.2 REGULATORY FRAMEWORK

#### 2.2.2.1 The Natural Resources Conservation Authority Act, 1991 and Regulations

The NRCA is established under this Act, a key mandate of which is "the effective management of the physical environment of Jamaica so as to ensure the conservation, protection, and proper use of its natural resources…". The National Environment and Planning Agency (NEPA) executes the technical and scientific functions of the NRCA's mandate.

*Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996 and the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development (Amendment) Order, 2015 - T*he first of these two Orders designates "The Island of Jamaica the Territorial Sea of Jamaica" as a prescribed area. Both Orders elaborate categories of enterprise.

*Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations, 2002* - These regulations give effect to some of the provisions of the Basel Convention to which Jamaica is a Party. Shipments of PCB-containing waste and POPs pesticides have been exported for disposal under these regulations. The importation of hazardous waste, including POPs waste, is prohibited.

*Natural Resources Conservation (Permits and Licences) Regulations, 1996 and The Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015* - These regulations stipulate the categories of enterprise that require permits and environmental impact assessments prior to construction and operation and set out the process of obtaining permits. The definition of "hazardous waste" under the regulations would include POPs, while many of the source categories for UPOPs are listed in the industries that require permits. A licence is required for the discharge of sewage and trade effluent. The environmental impact assessment is the mechanism whereby NEPA can disallow developments that may pose a high risk to human health and the environment without adequate mitigation measures. Conversely, the mechanism allows permits and licences to be granted once the Agency is satisfied that environmental and health risks are adequately mitigated.

*Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013* – These regulations provide details of (i) the licencing process for the discharge of sewage, trade effluent, and sludge and (ii) procedures for monitoring for compliance with standards. Standards for sewage, effluent, trade effluent, and for categories of sludge are set out in the Third Schedule. Table 7, lists the maximum allowable concentrations of 23 chemical substances in solid waste/industrial sludge

suitable for landfill, and includes five of the initial twelve POPs – DDT, endrin, heptachlor, and lindane (listed as a POP in 2009).

*Natural Resources Conservation Authority (Air Quality) Regulations, 2006 – These regulations set out:*

i. the process for obtaining an air pollutant discharge licence, required for all significant facilities;
ii. procedures for monitoring pollutants and for ensuring and enforcing compliance with standards.

All twelve initial POPs are listed in the Second Schedule as Priority Air Pollutants and hourly, daily, or annual allowable concentrations ($\mu g/m^3$) are prescribed for all except endrin and mirex. No methods for detection or measurement of the POPs are suggested in the Twelfth Schedule "Test Methods for Stack Emission Monitoring". The categories of air pollutant sources (Fourth Schedule) include most UPOP source categories.

*Natural Resources Conservation (Environmental Protection Measures) Order, 2016* - This order prohibits open burning in watershed areas during the months of February to October. Burning of sugar cane as a pre-harvesting activity is excepted.

#### 2.2.2.2 The Forest Act, 1996

This Act contains provisions for protection against forest fire and burning of vegetation, both of which are UPOP-generating activities.

#### 2.2.2.3 The Precursor Chemicals Act, 1999

This Act specifically regulates the 36 chemicals listed in the First Schedule – deemed to be precursors and reagents for the preparation of narcotics and other illicit substances. Only under the provisions of the Act can these chemicals be produced, manufactured, prepared, distributed, imported, or exported. The importation, manufacture, and export of other chemicals "in significant quantities" are defined as "prescribed activities" and must be conducted in compliance with the requirements of the Act. In practice, the Act is applied to regulate the importation (by a process of a permit application and issue) of consumer and industrial chemical products and fertilizers with far greater frequency and in much higher quantities than to the specified precursor chemicals and reagents. Decisions to grant permits for importation of substances are informed by national legislation and by international databases.

#### 2.2.2.4 The Pesticides Act, 1975

The Pesticides Act establishes the Pesticides Control Authority, the functions of which include

- Registering pesticides for import or manufacture
- Designating pesticides as being prohibited from use (listed in the Second Schedule)
- Designating pesticides for restricted use (listed in the Third Schedule)

There are 18 POPs with pesticidal applications listed in the Stockholm Convention; of these, 8 were listed under the Convention between 2009 to 2018, 13 are among the pesticides designated as prohibited from use in Jamaica and one is for restricted use – See Table 2.1 below.

**Table 2.1: Status of POPs pesticides under the Pesticides Act, 1975**

| | Name | Year listed | Status |
|---|---|---|---|
| 1 | Aldrin | Initial POP | Prohibited (Second Schedule) |
| 2 | Chlordane | Initial POP | Prohibited (Second Schedule) |
| 3 | Chlordecone | 2009 | Prohibited (Second Schedule) |
| 4 | DDT | Initial POP | Prohibited (Second Schedule) |
| 5 | Dieldrin | Initial POP | Prohibited (Second Schedule) |
| 6 | Endrin | Initial POP | Prohibited (Second Schedule) |
| 7 | Endosulfan | 2011 | Prohibited (Second Schedule) |
| 8 | Heptachlor | Initial POP | Prohibited (Second Schedule) |
| 9 | Hexachlorobenzene (also an industrial chemical) | Initial POP | Prohibited (Second Schedule) |
| 10 | Lindane | 2009 | Prohibited (Second Schedule) |
| 11 | Mirex | Initial POP | Prohibited (Second Schedule) |
| 12 | Pentachlorophenol | 2015 | Prohibited (Second Schedule) |
| 13 | Toxaphene | Initial POP | Prohibited (Second Schedule) |
| 14 | Dicofol | 2019 | Restricted (Third Schedule) |
| 15 | Alpha hexachlorocyclohexane (α-HCH) | 2009 | Not mentioned |
| 16 | Beta hexachlorocyclohexane (ß-HCH) | 2009 | Not mentioned |
| 17 | Pentachlorobenzene (PeCB) (also an industrial chemical) | 2009 | Not mentioned |
| 18 | Perfluorooctane sulfonic acid (PFOS), its salts, & perfluorooctane sulfonyl fluoride (also an industrial chemical) | 2009 | Not mentioned |

#### 2.2.2.5 The Public Health Act, 1985, the Public Health (Nuisance) Regulations, 1995 and the Public Health (Tobacco Control) Regulations, 2013

Although POPs are not specified, by implication the Act enables designated authorities to regulate matters in areas that may be impacted by POPs or generate UPOPs – public sanitation, pest control, and air and soil pollution, as well as storage and disposal of POPs-containing materials. The nuisances listed in the regulations include "dust, fumes, gases or effluvia emitting from any manufacturing process…". Persons who cause or permit nuisances are subject to prosecution if the nuisance is not abated within a specified time. Tobacco smoking, regulated under the 2013 Regulations, is listed among the UPOPs source categories.

#### 2.2.2.6 The Clean Air Act, 1981

Under the Clean Air Act owners of industrial facilities are required to minimize the escape and discharge of noxious or offensive gases, listed in the Schedule according to their sources (seven). The sources of these seven types of emissions are a subset of the UPOP source categories.

#### 2.2.2.7 The Country Fires Act, 1942 (amended 1995)

The deliberate setting of fires is regulated under this Act. The fines are low (however, the Act is scheduled to be updated). Enforcement of this legislation bears on the formation of UPOPs.

#### 2.2.2.8 The Customs Act, 1941

The prohibition of imports of POPs-containing articles by the Jamaica Customs Agency would derive from other laws, as stated in section 40 of the Customs Act "Goods prohibited to be imported" section (xxii) "such other articles…the importation of which is prohibited or may be prohibited from time to time, by law".

#### 2.2.2.9 The Trade Act, 1955 and Relevant Orders

Under section 8(1) of this Act, the relevant Minister is empowered to:

a. prohibit "the importation or exportation of goods or any class or description of goods from or to any country;"
b. prohibit "the importation or exportation of goods or any class or description of goods from or to any country except under the authority of a licence granted by the Minister;"
c. regulate "the distribution, purchase or sale of goods or any class or description of goods;"

The Act controls the import and export of substances and articles that could have deleterious effects on the environment. The Act is designed to be generic and is most effective when used in conjunction with prohibition orders. In the past, all successful bans on substances and articles other than drugs, precursor chemicals or pesticides have been through trade prohibition orders. A very recent example is the ban on single-use plastic bags.

*The Trade (Montreal Protocol) (Trade in Ozone Depleting Controlled Substances) Order, 2014*
This order prohibits and restricts the import of ozone-depleting substances, giving effect to the provisions of the legally binding Montreal Protocol on Substances that Deplete the Ozone Layer.

#### 2.2.2.10 The Standards Act, 1969

This Act establishes the Bureau of Standards and the Standards Council and prescribes their functions and the composition of the Council. The formulation, promulgation, application, and enforcement of standard specifications for commodities are among the functions of the Bureau. The BSJ ensures that there is adherence to the following labelling standards.

| | |
|---|---|
| JS ISO 14020: 2001 | Environmental labels and declarations—General principles |
| JS ISO 14024: 2001 | Environmental labels and declarations — type 1 Environmental labelling — Principles and procedures |
| JS 1, 1992 | Part 1: The labelling of commodities. Part 1: General principles |

#### 2.2.2.11 The Occupational Safety and Health Act, 2017 draft

This Act, which was originally drafted in the late 1990s, seeks to address deficiencies in the Factories Act. Since November 2018, it has been under review by a specially constituted Joint Select Committee of Parliament (JSCP) and is at an advanced stage. Upon completion of this review, a report will be tabled in Parliament along with a draft of the Bill that encompasses the new changes. The provisions of this new draft will then be debated in both Houses of Parliament. Once settled, the Minister of Labour will set a date on which the legislation will take effect. The definitions “hazardous chemicals” and “hazardous substances” in the draft legislation cover POPs.

#### 2.2.2.12 The National Solid Waste Management Act, 2001 and Regulations

This Act establishes the NSWMA and lays out the framework for the management and regulation of solid waste. This is a modern piece of legislation that encompasses key environmental considerations. The definitions of “hazardous waste”, “sanitary landfill” and “solid waste”,

and the sections indicated below are particularly relevant to the present context and applicable to the management of POPs-containing waste.

- Sections 4(2)(a), (b), (g) and (i) empower the NSWMA to establish and manage sanitary landfills and to formulate and monitor compliance with "standards, guidelines and codes of practice relating to solid waste management; to "conduct seminars and provide appropriate training programmes… and gather and disseminate information relating to solid waste management"
- Sections 68(1)(a)-(c) provide for making regulations for
  - effecting "standards, recommended practices and health requirements for solid waste management and solid waste disposal facilities;"
  - "minimum standards, including design standards, in respect of solid waste disposal facilities"

"classification of solid waste and waste disposal licences and provisions relating to different classes of waste and waste disposal licences"

*National Solid Waste (Public Cleanliness) Regulations 2003* - This instrument enables the NSWMA to regulate illegal dumping across the island. Under these regulations, the National Solid Waste Management Act Fixed Penalty Notice (Litter Ticket) was promulgated on May 1, 2007. Through the Fixed Penalty Notice, the NSWMA has the power to ticket and charge offenders with fines as high as $10,000 per violation, a strategy aimed at discouraging littering and illegal dumping.

#### 2.2.2.13 The Fire Brigade Act, 1988

This act addresses the administration of the agency with the mandate to respond to fires (JFB) but does not currently address issues associated with devices and materials used for fire suppression, and the standards with which these should comply. Consideration could be given to introducing regulations requiring that firefighting foam complies with the current obligations of the Stockholm Convention.

#### 2.2.2.14 The Road Traffic Act, 2018 and Regulations, 2022

This Act establishes the Island Traffic Authority and the necessity for motor vehicles to obtain certificates of fitness, the prescribed requirements of which may include appropriately low levels of emissions, with implications for formation of UPOPs.

#### 2.2.2.15 The Disaster Risk Management Act, 2015

This Act established the Office of Disaster Preparedness and Emergency Management and includes provisions for disaster management, mitigation and lowering disaster-related risk in Jamaica.

#### 2.2.2.16 Relevant Legislation in Development

- The National Solid Waste Management (Disposal of Hazardous Waste) (Electronic and Electrical) Regulations (2017 draft) - Ministry of Local Government and Rural Development.
- The Hazardous Chemicals and Pesticides Management Act (2017 draft) – Ministry of Health and Wellness.

### 2.2.3 INSTITUTIONAL FRAMEWORK

For the reasons listed below, management of POPs requires close coordination between multiple ministries, departments, and agencies (MDAs).

- Differences in origin of POPs – importation, unintentional production
- Diverse applications of the POPs chemicals – pesticides, dielectric fluids, flame retardants
- Occurrence in all environmental compartments and in a myriad of materials and products, and the necessity for life cycle management of POPs-containing articles
- The wide-ranging obligations of Parties to the Stockholm Convention, as specified in Articles 3-16 of the Convention

Articles 3-16 of the Convention are summarized in Table 2.2, the MDAs with main responsibility and the legislation relevant to meeting the requirements of each Article are indicated. In the subsequent section, the roles of the MDAs listed in the table and of other supporting public sector entities are elaborated.

**Table 2.2: Institutions and legislation for implementation of the Stockholm Convention**

| Article | Ministry/Department/ Agency | Functions, Policies, Legislation |
|---|---|---|
| **Article 3:** Eliminate releases from intentional production & use; covers import & export for disposal | Ministry of Economic Growth and Job Creation (MEGJC) | National Technical Focal Point for the Stockholm Convention; National Focal Point for the Basel Convention.<br>Coordination of the formulation of policies & legislation as necessary for management of all POPs. |
| | National Environment & Planning Agency (NEPA) | Designated National Competent Authority for the Basel Convention.<br>Regulate export of hazardous waste Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations, 2002. |
| | Ministry of Health & Wellness (MOHW)<br>Pesticides Control Authority (PCA) | Regulate pesticides (18/30 POPs).<br>DNCA for the Rotterdam Convention (which lists 7/11 POPs that are industrial chemicals)<br>Pesticides Act, 1975. |
| | MOHW<br>Standards & Regulation Division (SRD) | Regulate importation of chemical products<br>Precursor Chemicals Act, 1999 |
| | Bureau of Standards Jamaica (BSJ)<br>National Compliance & Regulatory Authority (NCRA) | Facilitate standards development process and promulgate standards;<br>monitor imports<br>Trade Act, 1955 & relevant regulations<br>Standards Act, 1969 |
| | Jamaica Customs Agency | Monitor import & export of all goods<br>Customs Act, 1941<br>Customs (Amendment) Act, 2001 |
| **Article 4:** Register of specific exemptions (additional to those listed in Annexes A & B of the Convention) document | MEGJC | National Technical Focal Point for the Convention |

| Article | Ministry/Department/ Agency | Functions, Policies, Legislation |
|---|---|---|
| **Article 5:** Measures to reduce or eliminate releases from unintentional production, including: (i) development & implementation of an action plan for UPOPs; (ii) UPOP inventory & report every 5 years; (iii) monitoring of relevant policies & legislation; promotion of reduction measures (BAT-BEP) | MEGJC | Manage periodic reviews, updates, & reports on the inventory of UPOPs<br>Monitor policies & laws for management of releases of UPOPs |
| | NEPA | Manage releases of UPOPs through licencing & monitoring of emissions from industries; enforce laws & standards<br>NRCA Act, 1991.<br>The Natural Resources Conservation (Permits and Licences) Regulations, 1996; The Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015; The Natural Resources Conservation (Ambient Air Quality Standards) Regulations, 1996; The Natural Resources Conservation Authority (Air Quality) Regulations, 2006; The Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013 |
| | Ministry of Local Government and Rural Development (MLGRD) | Regulate open burning of vegetation<br>Country Fires Act, 1942 |
| | Jamaica Fire Brigade | Prevent & suppress fires<br>Fire Brigade Act, 1988 |
| **Article 6:** Measures to reduce or eliminate releases from stockpiles & wastes | NEPA | Issue permits for construction and operation of chemical and hazardous waste storage as well as, monitor storage sites and stockpiles for compliance with The Natural Resources Conservation (Permits and Licences) Regulations, 1996;<br>The Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015<br>NRCA Act, 1991<br>See also NEPA's functions under Article 3 |

| | | |
|---|---|---|
| | Municipal Corporations | The Local Authorities have regulatory powers with respect to building permits for chemical storage and hazardous waste storage sites. The sites must be in conformance with the Local Sustainable Development Planning Framework |
| | National Solid Waste Management Authority (NSWMA) | Establish & manage appropriate waste disposal facilities<br>National Policy for the Environmentally Sound Management of Hazardous Wastes<br>National Solid Waste Management Act, 2001 |
| **Article 7:** Implementation Plans | MEGJC | Manage periodic reviews, updates, & submissions of NIP |

| Article | Ministry/Department/ Agency | Functions, Policies, Legislation |
|---|---|---|
| **Article 8:** Listing of chemicals in Annexes A, B, & C | MEGJC | Monitor international developments<br>Consult with local stakeholders |
| **Article 9:** Information exchange (with other Parties through the Convention Secretariat) | MEGJC | |
| **Article 10:** Public information, awareness, & education | MDAs | Promote public education and training about POPS by all MDAs involved in the regulation/management of POPs |
| | NEPA | Collect & disseminate information through the Pollutant Release & Transfer Register (PRTR) |
| | MDAs | Access to Information Act, 2004 (for information access by the public) |
| **Article 11:** Research, development, & monitoring | MEGJC, MOHW, PCA, MLGRD, NEPA | Endeavour to facilitate projects to monitor levels of POPs in the local environment, food chain, & population |
| **Article12:** Technical assistance (provision of) | Not applicable to Jamaica | |

| | | |
|---|---|---|
| **Articles 13 & 14:** Financial resources Article 13 (1) – Funding for national activities Article 13 (2)-(8) & Article 14 | MEGJC, Ministry of Finance & the Public Service Not applicable to Jamaica | |
| **Article 15:** Reporting | MEGJC | Collect information for submission of future reports |
| **Article 16:** Effectiveness evaluation | MEGJC | In collaboration with other Parties in the region; contingent on activities carried out in fulfilment of Articles 11 & 15 |
| **Articles** 17-30 | Not relevant to the NIP | |

#### 2.2.3.1 Ministry of Economic Growth and Job Creation (MEGJC) and its Agencies

Portfolio responsibility for the environment lies within this Ministry which, as the National Technical Focal Point for the Stockholm Convention, coordinates all implementation activities and represents the GOJ at the Conference of the Parties. The Environment and Risk Management Branch (ERMB), responsible for coordinating the management of chemicals and hazardous waste, is the unit directly concerned with POPs management. The functions of the Branch are:

- Development, monitoring, guiding, and evaluation of relevant national legislation, plans, and policies
- Leading interagency coordination on national chemicals management; the ERMB coordinated the preparation of the draft *Protocol for the Regulation of Chemical Imports within Jamaica's Jurisdiction* (July 2013)
- Preparation of the country's national reports to the Stockholm Convention and development of the NIP.

The ERMB is the National Focal Point for the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

The National Meteorological (MET) Service, also located in this Ministry, provides weather reports and forecasts to support planning and response to disasters involving hazardous wastes.

*The Forestry Department (FD)* - The FD, an Executive Agency established under the Forest Act, 1996, is charged with managing 40% of Jamaica's land area that is forested. The FD exercises direct responsibility over the portion that is publicly owned (116,862 Ha, 26% of the

country's land area), designated as Crown land. There are declared protected areas on both public and private land; protection includes protection against fire, and burning or clearing of vegetation within a protected area is subject to regulation.

*National Environment and Planning Agency (NEPA)* - NEPA is an Executive Agency responsible for the management of chemicals and POPs that operates within the legislation shown in Table 2.2. The following four of NEPA's seven core functions have a direct bearing on POPs.

- Environmental management – pollution prevention, control, monitoring, assessment, and incident investigation and reporting
- Compliance and enforcement
- Applications management (pesticides excepted, see section 2.2.3.3 above)
- Public education

In this context, the relevant operations of NEPA are as follows:

a. Issuing of permits and licences and prohibition of the importation of hazardous wastes.
b. Monitoring of chemicals in the environment for compliance with discharge licences and national standards.
c. NEPA is Jamaica's Designated Competent Authority in accordance with Article 5 of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

*Water Resources Authority (WRA)* - This Agency, established under the Water Resources Act, 1995, is responsible for the management of water resources in Jamaica. Functions include:

- resource monitoring and assessment through hydrologic data collection, compilation and analysis
- licencing for drilling of wells and abstraction of surface and groundwater resources
- flood assessments
- water quality monitoring.

The latter function could be relevant to POPs management, as the POPs that are industrial chemicals are frequently found as pollutants in groundwater.

#### 2.2.3.2 Ministry of Health and Wellness and its Agencies

*Pesticides Control Authority (PCA)* - The PCA is a statutory body established under the Pesticides Act, 1975 that regulates all aspects of registration, licencing, importation, manufacture, packaging, preparation for sale, sale, use, and disposal of pesticides; the agency also deploys significant resources to public education. The PCA is guided by a Board appointed by the Minister. A technical interagency committee established by the Board, the Pesticides Review Committee, advises the PCA on risks, use, restrictions, and phase-out of pesticides. The operations of the PCA are funded by a government levy of 2% of the value of imported pesticides. The PCA is the Designated National Authority for the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention). Twelve of the 15 POPs with exclusively pesticidal applications are listed in the Rotterdam Convention, as well as six of the eleven POPs that are industrial chemicals.

*Standards and Regulation Division (SRD)* - One of the main stated responsibilities of this division is the regulation of chemicals, pharmaceuticals, and other designated products. The importation of all chemicals is regulated through the Pharmaceutical and Regulatory Affairs Department within the SRD. The SRD has specific legislative authority for the 36 substances listed in the Precursor Chemicals Act, 1999. All other industrial and consumer chemicals, and fertilizers are regulated administratively through a process of permit application and issue. Generally, permits are for products containing specified chemicals and not for pure chemical substances.

*Department of Government Chemist* - This is a public regulatory laboratory that provides technical and scientific advice and analytical chemical services. Among the four analytical divisions is the Industrial Chemicals and Pesticides Laboratory which analyses pesticides and classifies goods for customs/revenue protection purposes and carries out ad hoc analyses of industrial chemicals.

*Environmental Health Unit (EHU)* - This unit operates under the Public Health Act, 1985 and enforces regulations from other acts that relate to public health and the environment. The EHU can regulate open burning of household and other waste, burning of sugar cane fields, and emissions from sugar factories insofar as these constitute nuisances to public health.

#### 2.2.3.3 Ministry of Science, Energy and Technology (MSET)

The key functions of MSET are aligned with the mandates of the divisions and agencies within its portfolio. The Energy Division of the Ministry oversees the functioning of the energy sector. It monitors energy supplies and the identification of alternative energy sources, as well as energy conservation. The Science and Technology Division is responsible for monitoring developments in the Information and Technology sectors, encompassing issues related to job creation and Jamaica's advancements in technological innovation.

#### 2.2.3.4 Ministry of Finance and the Public Service and its Agencies

*Jamaica Customs Agency (JCA)* - The Jamaica Customs Agency is an Executive Agency that operates within the framework of the Jamaica Customs Act, 1941 and the Jamaica Customs (Amendment) Act, 2001. Jamaica Customs monitors and regulates the import and export of goods, which must comply with the applicable legislative requirements, and collects revenue. Customs, therefore, performs agency functions on behalf of the MDAs that have direct responsibility for the acts and associated regulations pertinent to POPs.

#### 2.2.3.5 Ministry of Industry, Investment and Commerce and its Agencies

*Bureau of Standards Jamaica (BSJ)* – Using a system of technical committees comprising relevant stakeholders the BSJ (established by the Standards Act, 1969) develops product standards and labelling regulations for consumer items, generally in response to recognized needs, through a defined process that culminates in gazetting. In some instances, the BSJ, as a member of the International Organization for Standardization (ISO), adopts as appropriate, the ISO standards as Jamaican standards. Through the formulation of these standards and labelling regulations, the BSJ ensures consumers are protected from harmful pollutants including POPs.

*National Compliance and Registration Authority (NCRA)* — The NCRA began operations in January 2016 to transfer regulatory functions from the BSJ to an independent body. This is in compliance with the World Trade Organization Technical Barriers to Trade arrangements wherein regulatory activities, monitoring, inspection and enforcement responsibilities must be separated from the standards-setting body. Goods are checked for compliance with standards and regulations by the inspectors of the NCRA operating at the ports, at wholesale and retail facilities, and at points of manufacture before entering into the trade. Through these inspections, the NCRA can ascertain whether a product contains harmful pollutants such as POPs Items that do not conform to labelling standards or for which importation is prohibited may be subject to detention.

*Jamaica National Agency for Accreditation (JANAAC)* – The Jamaica National Agency for Accreditation (JANAAC) was established in 2008 as an agency of the Ministry of Industry, Investment and Commerce to improve Jamaica's trade competitiveness by bringing local conformity assessment bodies (CABs), including laboratories, certification bodies, inspection bodies, to international standards. JANAAC evaluates laboratories against either the ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" or ISO 15189 "Medical laboratories – Particular requirements for quality and competence". Several local laboratories have received accreditation from JANAAC for specific analytical methods. The JANAAC ensures that the testing organizations have the requisite competencies to test for pollutants such as POPs.

*Trade Board* – The Trade Board is a regulatory agency operating under the Trade Act, 1955 that has among its responsibilities "issuing import and export licences for specific items that may have a negative impact on the environmental, social, or economic conditions of the country". In particular, the Trade Board has responsibility for issuing licenses for the importation of motor vehicles, which may consist of materials that contain POPs. Jamaica, as a Party to the Stockholm Convention, is therefore encouraged to carefully monitor the importation of motor vehicles to reduce the quantity of POPs. The Trade Board, under the aegis of the Motor Vehicle Import Policy, 2014, which cites environmental protection as a consideration, ensures that there is strict adherence to the age limit for new and used motor vehicles imported into the country.

*Consumer Affairs Commission (CAC)* – The CAC protects the interests of consumers through implementation of the provisions of the Consumer Protection Act, 2005 and the Consumer Protection (Amendment) Act, 2012. This mandate is accomplished through the Commission's consumer education programmes, complaints resolution service, and its corporate services and affiliations.

#### 2.2.3.6 Ministry of Labour and Social Security (MLSS)

*The Occupational Safety and Health Department of the MLSS*, in fulfilling its responsibility for protecting the safety of workers, promotes safe handling and awareness of the hazards of using chemicals through enforcement of the Factories Act, 1943 (as amended), the main *OSH Act*, and its accompanying Regulations – the Factories Regulations 1961, and the Building Operations and Works of Engineering Construction (Safety, Health and Welfare) Regulations, 1968. These hazards could include POPs and POPs-containing materials. The MLSS also applies the International Labour Organization Chemicals Convention, 1990 to which Jamaica will not be a Party until the Occupational Safety and Health bill (The Occupational Safety and Health Act, 2017 draft) is enacted.

#### 2.2.3.7 Ministry of Local Government and Rural Development and its Agencies

*National Solid Waste Management Authority (NSWMA)* - The NSWMA, established under the National Solid Waste Management Act, 2001, is mandated to collect, store, transport, recycle, reuse, and dispose of solid waste (including hazardous waste) in safe and environmentally sound ways and to promote safety standards in relation to waste. The NSWMA maintains a commercial site for disposal of asbestos (asbestos cell) at the Riverton Disposal Facility, but the capacity to manage other categories of hazardous waste is currently limited. The NSWMA has the responsibility to operate the municipal disposal sites in a manner to prevent deliberate and spontaneous fires.

*Jamaica Fire Brigade (JFB)* - The Jamaica Fire Brigade (JFB), established under the Fire Brigade Act, 1988, is the primary fire and rescue emergency response organization in Jamaica and the first responder for all chemical emergencies on land. The fire and rescue/fire suppression activities of the JFB include emergency responses to spills and releases of chemicals, chemical wastes and hazardous materials. The mandate of the Fire Prevention Division is public education and fire inspection of public buildings. Additionally, the Fire Brigade collects data on incidental fires (numbers, types, sources); these constitute a source category for UPOPs inventories.

*Office of Disaster Preparedness and Emergency Management (ODPEM)* - This agency is established under and administers the Disaster Risk Management Act, 2015. ODPEM is continuously involved in all areas of risk management and coordinates disaster risk management nationally. In the event of a national emergency, ODPEM coordinates the responses of the first responders.

*Municipal Corporations (MC)* - The Local Authorities are empowered to make by-laws, regulations and rules for good governance of the parishes over which they have jurisdiction. In this regard, the Authorities can assist with the regulation of POPs within their respective parishes.

#### 2.2.3.8 Ministry of Transport and Mining and its Agencies

*Jamaica Bauxite Institute (JBI)* - The JBI is the link between the GOJ and the companies engaged in bauxite mining and alumina production locally. The JBI is charged with monitoring, evaluating and conducting research on the bauxite/alumina industry and protecting the interest of the

GOJ in the industry. Under a Memorandum of Understanding between the JBI and the Natural Resources Conservation Authority (NRCA) responsibility for the following functions has been delegated to the JBI.

- Environmental management of the bauxite/alumina industry
- Monitoring of the impacts of the industry on the environment

The JBI has a potential role in supporting the POPs management initiatives of the GOJ insofar as some bauxite-alumina companies may still hold PCB-containing equipment.

#### 2.2.3.9 Ministry of Foreign Affairs and Foreign Trade (MFAFT)

The MFAFT mediates Jamaica's participation in the MEAs to which the country is signatory and facilitates access to resources available through development assistance and technical cooperation from multilateral and bilateral donors. The country's involvement in the chemicals management MEAs is enabled mainly through the Permanent Mission to the Office of the United Nations and Specialised Agencies in Geneva, the location of the Secretariats for the Basel, Rotterdam and Stockholm Conventions. The MFAFT is the official National Focal Point for the Stockholm Convention on Persistent Organic Pollutants. The Foreign Trade Division of the MFAFT has responsibility for foreign trade policy and trade negotiations and represents Jamaica's trading interests bilaterally, regionally and multilaterally.

#### 2.2.3.10 Ministry of Justice

*Attorney General's Chambers* - In this Department, the International Division and the Constitutional and Legislation Division are relevant to management of POPs. The International Division advises on Jamaica's obligations under international agreements, while guidance on development of proposed legislation would be provided by the Constitutional and Legislation Division.

*Office of the Parliamentary Counsel* - The Office of the Parliamentary Counsel is responsible for the preparation of draft legislation, on instructions from Ministries. Parliamentary Counsel also advises Ministries on points of law relevant to proposed legislation.

#### 2.2.3.11 Inter-Ministerial Committees and Coordinating Mechanisms

*Central Health Committee* - The Central Health Committee (CHC), established under Section 3 of the Public Health Act, 1985, advises the Minister of Health and the Local Boards of Health on public health matters. The committee consists of eleven members appointed by the Minister of

Health to serve for a period of three years. Members include representatives from the MOHW (EHU), NEPA, MLGRD, MOAF (Veterinary Services), NWC, and a family physician. Co-opted members are representatives from other MDAs and the private sector. The management of hazardous substances and wastes is a subject of interest for this committee, especially in relation to public health. The management of lead (Pb) from spent lead/acid batteries and pesticide residues in drinking water are examples of some areas of concern and focus for the CHC.

*Hazardous Waste Applications Review Committee* - The function of this committee is to review applications made under the Natural Resources (Hazardous Waste) (Control of Transboundary Movements) Regulations 2002 and to make recommendations to NEPA to grant or refuse permits. The members represent the following government agencies: BSJ, JCA, JFB, JCF, Maritime Authority of Jamaica, Attorney General's Chambers, NEPA, NSWMA, ODPEM, Port Authority of Jamaica, and MEGJC.

*National Chemicals Review Committee* - This committee provides guidance to the MEGJC in formulating positions for Jamaica on matters relating to chemical risk, as required by the country's participation in the international conventions, and protocols and mechanisms for monitoring and safe management of chemicals. Membership is drawn from the following: BSJ, MOAF (RADA, Veterinary Services), MOHW (EHU, Government Chemist, PCA, Standards and Regulation Division), Attorney General's Chambers, MEGJC, NEPA, NSWMA, UWI. Meetings of the committee are convened on an ad hoc basis.

*Pesticides Review Committee* - The Pesticides Review Committee is the technical committee that makes recommendations to the Pesticides Control Authority (PCA). It consists of representatives from relevant MDAs and from academia. The following MDAs and institutions are represented: MOAF (Bodles Research Station, RADA), MOHW (EHU, Government Chemist), MEGJC, NEPA, UTECH, and UWI. The Registrar and Deputy Registrar of the PCA are not members of the committee but are in attendance at the meetings. Recommendations to the Board are based on technical information.

### 2.2.4 RELEVANT INTERNATIONAL COMMITMENTS AND OBLIGATIONS

#### 2.2.4.1 Membership in Regional Institutions

Jamaica is a member of the three main regional institutions – the Caribbean Community (CARICOM), the Organization of American States (OAS) and the Association of Caribbean States (ACS).

*The Caribbean Community (CARICOM)* - This grouping of 20 countries (total population approximately 16 million) consists of 15 member states and five associate members; most are island states, except Belize, Guyana and Suriname. The original entity, the Caribbean Community and Common Market was established by the Treaty of Chaguaramas signed on 4 July 1973. Plans and programs were instituted to promote economic integration and coordinate efforts in the areas of foreign policy, human and social development and security. The treaty was revised in 2002, and the successor entity is the Caribbean Community, including the CARICOM Single Market and Economy (CSME). Regional institutions established under CARICOM that impact agriculture, health and education include the Caribbean Agricultural Development Institute (CARDI), the Caribbean Agricultural Health and Food Safety Agency (CAHFSA), the Caribbean Public Health Agency (CARPHA) and the Caribbean Examinations Council (CXC).

*The Organization of American States (OAS)* - The OAS, established in 1948, is a 35-member group of independent states in the Americas with major aims "to promote their solidarity, to strengthen their collaboration, and to defend their sovereignty, their territorial integrity, and their independence."[15] Specialized agencies established under the OAS include the Pan American Health Organization (PAHO), the Inter-American Children's Institute (IIN), the Inter-American Institute for Cooperation on Agriculture (IICA), the Pan American Institute of Geography and History (PAIGH) and the Inter-American Indian Institute (III). The OAS is the technical secretariat for the triennial Summits of the Americas – fora for discussions of policy issues and challenges faced in the Americas, attended by leaders of government in the Western Hemisphere. The OAS receives mandates from the Summits of the Americas; some of these mandates relate directly to chemical safety and environmental issues resulting from pollution by pesticides and other chemicals.

*The Association of Caribbean States (ACS)* - The ACS, formed in 1994, currently consists of 25 member countries and eight associate members. The five focal areas are disaster risk reduction, sustainable tourism, transport, the Caribbean Sea Commission, and trade and economic external relations. Under the latter, the ACS provides a framework for the discourse and activity necessary to advance economic integration and intra-regional trade and investment.

*Coordinating Group of the Heads of Pesticides Control Boards in the Caribbean (CGPC)* - The CGPC was formed in 1995 to harmonise the regulation of pesticides and develop standard procedures for registration, and monitoring systems for pesticide residue and to lobby for the enactment of the required legislation across the region. Members are representatives from the

pesticides and toxic chemicals control boards and authorities of the Caribbean, and associate members represent other stakeholders. The CGPC is integrated into the CARICOM, FAO, and OAS systems. The recently concluded GEF-funded project *Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean,* discussed elsewhere in this NIP, was implemented by the CGPC and the FAO.

#### 2.2.4.2 Multilateral Environmental Agreements to which Jamaica is Party or Signatory

Jamaica is party or signatory to a number of international conventions that are relevant to the management of POPs and other hazardous substances.

*Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* - Jamaica acceded to this MEA on 23 January 2003, with entry into force on 23 April 2003. The Technical Focal Point is the MEGJC and NEPA is the Competent Authority. The goal of the Basel Convention is the protection of human health and the environment from the adverse effects of the generation and management of hazardous wastes. The Convention

(a) prescribes procedures for the prior informed consent (PIC) of Parties to transboundary movements of hazardous and other wastes taking place from, through or to their territories, and (b) aims at ensuring the environmentally sound management of such wastes. Wastes containing chemicals listed under the Rotterdam and Stockholm Conventions are subject to the procedures and obligations of the Basel Convention. Jamaica is also a Party to the Amendment to the Basel Convention, commonly referred to as the Ban Amendment. Under this Amendment, transboundary movement of hazardous waste from OECD to non-OECD Basel Convention Party states is prohibited. The provisions of this Convention have been incorporated into Jamaican law pursuant to the Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations, 2002.

*Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade* - The Rotterdam Convention was ratified by Jamaica on 20 August 2002, with entry into force on 24 February 2004. Official contact points are the Ministers of Agriculture and Foreign Affairs and Foreign Trade, and the Designated National Authority is the Registrar, PCA. Pesticides and industrial chemicals that are banned or severely restricted for health or environmental reasons by Parties, as well as pesticides that present a risk under conditions of use in developing countries, may be subject to a legally binding prior informed consent (PIC) procedure and listing in Annex III of the Convention. Elements of this process are: (a) sharing of information with importing countries; (b) generation of a decision guidance document, its circulation to Parties, and solicitation and circulation of responses. Of

the 52 chemicals currently listed in Annex III of the Convention, 18 are POPs (twelve pesticides, five industrial chemicals, and one dual application).

*The Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer* - Jamaica acceded to both these agreements on the 31st March 1993 and they entered into force on the 29th June 1993. The National Ozone Unit, housed in NEPA, was established in 1997 to fulfil Jamaica's obligations to phase out Ozone Depleting Substances (ODSs) by implementing the national ODS phase-out programme and executing projects under the Multilateral Fund for Implementation of the Montreal Protocol. The provisions of this MEA have been incorporated into Jamaican law pursuant to several Orders under the Trade Act.

*The Minamata Convention on Mercury* - This MEA was ratified by Jamaica on the 19th of July 2017. The aim is to promote the protection of human health and the environment from intentional or unintentional use and release of mercury. Prior to ratification, Jamaica completed the Minamata Initial Assessment (MIA) project to strengthen national decision-making and build capacity for implementation. This project was funded by the GEF, implemented by UNEP and executed by the Basel Convention Regional Centre for Training and Technology for the Caribbean (BCRC- Caribbean).

*The Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean (the Escazú Agreement)* - Jamaica became a signatory to the Escazú Agreement in 2019 following extensive participation in the negotiation process for the development of this instrument. The Agreement seeks to ensure three fundamental rights: access to information, access to justice and access to public participation. In signing the Agreement, Jamaica communicated, *inter alia*, its support for citizens to be granted access to appropriate environmental information to promote transparency and accountability.

## 2.3 ASSESSMENT OF THE POPS ISSUE IN JAMAICA

### 2.3.1 ASSESSMENT OF POPS PESTICIDES (ANNEX A, PART I)

#### 2.3.1.1 Introduction – POPs Pesticides

Eight of the 16 Annex A, Part I pesticides were among the twelve initial POPs: aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene. Prior to the activities leading up to the 2005 NIP, importation of all eight of these pesticides to Jamaica

had been banned (in 1999) consequent on the results of studies of pesticide levels in Kingston Harbour and initiatives spearheaded by the Pesticides Control Authority. Nonetheless, a comprehensive inventory of POPs pesticide stocks and sites contaminated with pesticides was conducted for that NIP, and the findings and recommendations were incorporated into the plan. Key findings and recommendations are below.

a. Relatively small quantities of two POPs pesticides (total 31 L) were found stored at two sites. There were 16 other sites at which significant quantities of other obsolete pesticides were stored.
b. Recommendations encompassed all pesticides: (i) upgrading management of pesticide storage sites; (ii) identification and decontamination of pesticide-contaminated sites; (iii) development of mechanisms to halt importation of all illegal chemicals and to periodically dispose of harmful chemicals.

#### 2.3.1.2 Export of Obsolete Pesticides from Jamaica

In 2010, subsequent to the completion of the 2005 NIP, Jamaica participated in a regional GEF-funded project *Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean.* The project was implemented by the Food and Agriculture Organization of the United Nations (FAO) collaboratively with the Coordinating Group of Pesticides Control Boards of the Caribbean (CGPC) and operationalized at the local level by the Pesticides Control Authority (PCA). After the first phase (2010 – 2014), the project was expanded and extended and ended in 2019. Under the project the PCA:

- coordinated the collection and repackaging of obsolete pesticide stockpiles totalling ~80 t (Table 2.3) throughout the island and, in three containers and two shipments sent between March and December 2017, these were exported to the UK for environmentally safe disposal;
- identified and cleared all sites contaminated with POPs pesticides:
  - Coffee Board storeroom – a number of empty endosulfan drums were identified and disposed of (exported).
  - Hope Gardens Nursery – a heritage building in which stored endosulfan had leaked into the wooden floor. The floorboards were removed and disposed of.
  - Sugar Industry Research Institute (SIRI) near Mandeville – pesticides from the lab were found contaminating a concrete storeroom. The pesticides were removed, drummed, and exported and the space was cleaned.

The first two recommendations of the 2005 NIP have largely been met through this project and other ongoing activities of the PCA.

At least two private companies have also exported shipments of pesticides for disposal. Information on export shipments of obsolete pesticides is summarized in Table 2.3.

**Table 2.3: Export shipments of obsolete pesticides and contaminated material**

| Date | Exporter | Quantity | POPs specified (Kg) |
|---|---|---|---|
| 9/2017 | Agricultural Chemical Co. (former subsidiary of JWN) | 3,780 | No names given, so POPs not specified |
| 3-12/2017 | Pesticides Control Authority | 35,000 | No POPs among the pesticides named; contents of one liquid-containing 200 L drum & two solid-containing 200 L drums given as "mixed pesticides"; some "MT drums" would have contained endosulfan & some materials would be contaminated with POPS |
| 2009 | Carreras Ltd. | 12,000 | All names given; no POPs;<br>May be the pesticides mentioned in the 2005 NIP as stored at the Cigarette Company of Jamaica |

#### 2.3.1.3 Annex A POPs Pesticides Listed to the Convention since Jamaica's 2005 NIP

Table 2.4 shows the eight pesticides listed to the Convention 2009-2019 and their status under Jamaican law.

**Table 2.4: Annex A POPs pesticides listed since 2009 and status under the Pesticides Act, 1975**

| | Name | Year listed | Annex | Status |
|---|---|---|---|---|
| 1 | Dicofol | 2019 | A | Restricted (Third Schedule) |
| 2 | Pentachlorophenol | 2015 | A | Prohibited (Second Schedule) |
| 3 | Endosulfan | 2011 | A | Prohibited (Second Schedule) |
| 4 | Chlordecone | 2009 | A | Prohibited (Second Schedule) |
| 5 | Lindane | 2009 | A | Prohibited (Second Schedule) |
| 6 | Alpha hexachlorocyclohexane (α-HCH) | 2009 | A | Not mentioned |
| 7 | Beta hexachlorocyclohexane (ß-HCH) | 2009 | A | Not mentioned |
| 8 | Pentachlorobenzene (PeCB) (also an industrial chemical) | 2009 | A | Not mentioned |

Four of these eight pesticides are prohibited from use (banned) in Jamaica. Endosulfan was prohibited in 2011, concomitant with listing to the Convention (see section 2.3.17).

- Of note is the fact that lindane is not used locally to treat head lice.

- One pesticide (dicofol) is restricted
- Three of the eight pesticides are not mentioned in the Pesticides Act.
  - Two of these three (α-HCH, ß-HCH) are minor components/impurities of lindane

#### 2.3.1.4 The Current POPs Pesticides Situation in Jamaica

All aspects of pesticide management, including registration and importation, are regulated by the PCA. None of the three POPs pesticides not mentioned in the Pesticides Act, 1975 (Table 2.4, entries 6-8) were registered for use in Jamaica up to 2013 (PCA Annual Reports online). From information supplied by the Registrar of the PCA, no applications for registration of these three pesticides have been received subsequently. Jamaica, therefore, does not import Annex A, Part I POPs pesticides. Relatively minor legislative amendments to the Pesticide Act, 1975 are needed to include unregulated pesticides for the country to become compliant with the provisions of the Convention with respect to the importation of these POPs. However, indications are that there is a need to strengthen some processes around importation, such as ensuring the relevant officials are fully apprised of the POPs issues and increasing public awareness campaigns on the detrimental impacts of burning garbage as it relates to POPs.

### 2.3.2 ASSESSMENT OF POLYCHLORINATED BIPHENYLS, PCBS (ANNEX A PART II) AND POLYCHLORINATED NAPHTHALENES, PCNS (ANNEX A, PART I)

#### 2.3.2.1 Introduction – PCBs and PCNs

Polychlorinated biphenyls (PCBs) were among the twelve initial POPs and were inventoried for the 2005 NIP. Polychlorinated naphthalenes (PCNs) were listed to Annex A of the Convention in 2015. Like PCBs, the main applications of PCNs were as heat exchange and dielectric fluids. Production of PCNs ceased in the 1970s, and they were replaced by PCBs in the main applications. PCNs may occur as minor impurities of PCBs used in dielectric fluids; for this reason, the assessment of PCBs includes PCNs.

Locally, PCBs occur mainly in dielectric fluids used in electrical equipment – transformers, capacitors, fluorescent light ballasts and paper-insulated lead cables. During the 1990s, large quantities of PCB oil and PCB-containing electrical equipment and waste were exported for disposal. Some of these exports took place under the aegis of a bilateral agreement between the governments of Jamaica and France. The main exporters were the Jamaica Public Service Company (JPSCo), the leading electric utility company, and the bauxite-alumina transnational companies. A number of smaller entities also exported PCB equipment and waste in partnership with the large exporters. There are no public records of these exports as they predate Jamaica's 2003 accession to the Basel Convention, however, a rough estimate of quantities exported (based on company data and personal communication) is 900-1000 t.

PCBs Reported in Jamaica's 2005 NIP and Subsequent Activity

A summary of the PCB inventory conducted in June 2004 for Jamaica's 2005 NIP is given below.

**Transformers**

| | |
|---|---|
| • JPSCo out-of-service transformers | 152 with PCB concentration > 50 ppm<br>estimated quantity PCB 3.75 kg in 14,355 kg oil<br>(based on analytical data) |
| • JPSCo in service transformers | ca. 892* > 30 years old<br>assumed PCB concentration 500 ppm<br>estimated quantity PCB 40.49 kg in 80,990 kg oil<br>*rough estimate: 20% of 4,460 transformers > 30 years old |
| • Transformers in unspecified entities | 262<br>estimated quantity PCB 26.06 kg in 63,598 kg oil |
| • **Total PCB in transformers = 70.3 kg in 158,943 kg oil** | |
| Capacitors and ballasts | > 2,656 (PCB content unknown) |
| Paper-insulated lead cable (PILC) | > 13,396 m (PCB content unknown) |
| Fluorescent light ballasts | number unknown |
| Askarel awaiting export for disposal | 7,089 litres |

Available information on export of PCB equipment and waste and PCB inventories, 2004-present, is summarized in Table 2.5.

**Table 2.5: Export of PCB-containing materials for disposal and PCB inventories, 2004-present**

| Month/Year | Entity | Activity Items, *quantities* |
|---|---|---|
| 12/2004 | JPSCo | **Exported** for disposal<br>Dechlorinated transformer carcasses, wastes from dechlorination process, PCB oil (probably the Askarel inventoried)<br>Total wt. ***not reported*** |
| 2009 | JPSCo | **Inventory** of items in storage at Washington Boulevard facility<br>**800** pole mounted transformers; 7 pad mounted transformers; cores of substation transformers; |
| 12/2009 | JPSCo | **Exported** for disposal<br>**400** pole mounted transformers; 4 pad mounted transformers;<br>**20** drums oil* with PCB > 50 ppm<br>Total wt. **218 t** |
| 2010 | St. Ann Bauxite Ltd./Noranda Jamaica Bauxite Partners | **Exported** for disposal<br>Solid waste contaminated with PCB (light ballasts)<br>**350 kg** |
| 2016-2017 | JPSCo | **Exported** for disposal<br>**204** pole-mounted transformers; assorted PCB-contaminated waste<br>Total wt. **171 t** |

*weight = 20 x 209 litres x 0.9 kg litres$^{-1}$ = 3,672 kg

The amounts of PCBs in the exports were not quantified. Based on the number of transformers and the volume of oil in 20 drums (assuming 250 ppm), a conservative estimate of the actual PCB exported is **33 kg**.

#### 2.3.2.2 Survey of PCBs for the 2023 NIP

A survey of PCB equipment currently in use was carried out in September and October 2020, using the inventory that was conducted for Jamaica's 2005 NIP and information in Table 2.5 as the point of departure. PCB use was banned in 1979 and importation stopped, so for the purposes of this survey, the cut-off year after which the articles under consideration (transformers, capacitors, FLBs, PILC) were manufactured without PCBs is 1980. Most of these articles are at the end of their service lives, which range from 12-40 years.

In the Jamaican context, a critical limitation is that there is no local regulatory requirement for companies to report on PCBs in equipment.

**Definitions**

*Non-PCB transformer* – any transformer containing oil with concentration < 50 ppm PCB

*PCB-contaminated electrical equipment* – any electrical equipment, including transformers, that contains concentrations of PCB ≥ 50 ppm but < 500 ppm

*PCB equipment* – any manufactured article that contains PCBs, including FLBs

*PCB transformer* – any transformer that contains oil with concentration ≥ 500 ppm PCB

**Site Visits**

- Site visits were made to 22 facilities during the period 29th September – 30th October 2020 in respect of the PCB survey.
- Seven companies were contacted for prospective site visits but declared that there is no PCB equipment on their sites, as (a) all transformers and capacitors in use were acquired after 1980 and (b) the company had exported all PCB-containing equipment for disposal. These seven companies were not visited.
- Eleven (11) of the 22 sites visited did not have PCB-containing equipment on site. Equipment in use had been acquired after 1980 and older equipment had been exported for disposal.
- There was no operating entity at one (1) site that was visited on the basis of information that leaking transformers had been located there.
- PCB-containing equipment and materials were present at ten (10) sites, viz.
    - JPSCo materials in storage and secured, awaiting export for disposal;

- three transformers at one (1) site containing oil with PCB concentration > 50 ppm; this site also housed a length of PILC;
- PILC was determined to be present at three (3) sites – eight meters at one site and undetermined lengths at the other two sites;
- at one site there were PILC, FLBs and some very old transformers (dates of manufacture 1960s); oil from a number of these transformers was analysed and found to contain < 50 ppm PCB.
- FLBs were the only PCB-containing articles seen at four (4) sites.

**Sampling and Analysis**

Thirty samples were collected at seven of the sites visited. Seven of these samples were from the site at which there were some very old transformers in use (dating back to the 1960s), and of these seven samples, four were soil samples collected from areas around leaking transformers. The 30 samples were analysed by the Pesticides Research Laboratory, UWI using GC-ECD and PCB standards supplied by UNEP. No PCBs were detected in 17 of the samples. For the remaining 13 samples, PCBs were detected in the concentration range of 0.0017 – 2.33 ppm, well below the 50 ppm concentration which is the upper limit for PCB-free oil or articles.

#### 2.3.2.3 Results of the Survey of PCBs for the 2023 NIP

**Transformers**

Estimates of the quantities of PCBs contained in transformers are given in Table 2.6 below

**Table 2.6: PCBs contained in transformers, 2020**

| Entity | Quantity | Total Weight (kg)/ Volume (L) | ppm (mg/kg)(mg/L) | PCB (kg) |
|---|---|---|---|---|
| Caribbean Products Company Ltd | Transformers > 50 ppm PCB ID numbers (weight)<br>8018727 (470 kg)<br>8511272 (425 kg)<br>851 1271 (425 kg) | 1,320 | 250 | 0.33 |
| Jamaica Public Service | 14 x empty pad mounted Transformers[a] | 14 x 1,400 = 19,600 | 500 | 9.8 |
| | 17 x Transformer oil cores (crated) | 17 x 80[b] = 1,360 | 500 | 0.68 |
| Jamaica Public Service (in-service) | 5 in-service Transformers[c] | 12,300 | 500 | 6.15 |
| Savannah-la-mar Hospital | 2 x Transformers[d] | 1,438 | 500 | 0.72 |
| **MINIMUM TOTAL PCBs IN PCB-CONTAINING TRANSFORMERS** | | | | **17.68** |

[a]Assume average weight of each transformer is 4000 kg[2] and 30 % is weight of the oil. Weight of empty transformer is 2,800 kg. Percentage core and winding is 50% = 1400 kg.

[b]Using an average weight of the core as 80kg.

[c]Assume 2,460 L per unit, assume 5 units

[d]Assume average volume of 719 L per unit

The minimum weight of PCBs in transformers that will need proper disposal is **17.68 kg**

## Capacitors

There were no capacitors identified in this inventory that pre-date the 1980 benchmark. The 2004 Inventory recorded 2,090 such capacitors, but it was not specified where these were found. It may be that these were found in companies that carried out overseas disposal not reflected in public records. JPSCo did not report any capacitors in their PCB inventory, but this will require confirmation.

## Paper Insulated Lead Cables

The total length of PILC at six locations (some not visited, but reported by JPSCo) was estimated to be **13,495 m**. Unknown lengths of PILC were present at three other locations. There is no basis on which to calculate the amount of PCBs in these cables.

## Fluorescent Light Ballasts

Twenty-five vintage FLBs were seen in the survey. The amount of PCB in each light ballast is 10 grams/fixture as estimated by General Electric.[16] This means that there is a minimum of **250 g (0.25 kg) PCB** still installed and an unknown amount at the NSWMA disposal sites as many companies reported disposal with the general trash that goes to these municipal sites.

## Mixed Waste

The survey also identified mixed wastes (Table 2.7) including used spill pads and PCB test kits as well as five 40-ft containers that were previously used to store PCB-contaminated material. The contribution from this source to the PCB loading is 0.05 kg.

**Table 2.7: PCB-containing mixed waste**

| Company | Description | Quantity | Weight per unit (kg) | Total Weight (kg) | ppm mg/kg | Weight PCB (kg) |
|---|---|---|---|---|---|---|
| JPSCo | 40-ft containers | 5 | 3629 | 18145 | 2 | 0.04 |
| | 55 gal drums PCB Oil Contaminated Material | 14 | 18.14 | 253.96 | 50 | 0.01 |
| **Total Minimum Weight** | | | | | | **0.05** |

Assume: weight per container is 3629 kg; clean-up to 2 ppm; 18.14 kg per drum

Total PCB Loading

The minimum total PB loading is approximately 18 kg, with contributions as shown in Table 2.8

**Table 2.8: Contributions to total PCB loading**

| Article | Quantity (kg) |
|---|---|
| Transformers | 17.68 |
| Capacitors | 0 |
| Fluorescent Light Ballasts | 0.25 |
| Mixed Waste | 0.05 |
| **Minimum total PCB loading** | **17.98** |

In addition to this, there is a minimum of 13,495 m of PILC.

Most PCB-containing equipment and material is held by the Jamaica Public Service, the major provider of electricity, in the form of transformers, PILC and mixed waste. The inventory is likely to be incomplete and there may be additional PCB-containing transformers within the network. The PILC listed in this survey is the same as listed for the 2004 inventory, as the company has not confirmed that these cables have been removed. PILC installations are mainly underground and there is a significant cost associated with removal and replacement. The challenge will be for the JPSCo to remove and replace these items prior to 2025. Some of the PCB-containing

articles identified are owned by the organizations at which they were located. These entities will need to remove and replace the PILC and transformers, some of which are still in service.

**Summary**

| | |
|---|---|
| 2004– the estimate of PCB present in-country was approximately | 70 kg |
| 2005-present – estimated PCB in oil and equipment exported for disposal, approximately | 33 kg |
| 2020 – the estimate of PCB contained in major equipment present in-country | > 18 kg |

The first two estimates are based on rather broad assumptions and are therefore subject to uncertainty. The quantity of PCB estimated in the 2020 inventory is a minimum.

#### 2.3.2.4 Prospects for Meeting the Stockholm Convention Timelines for PCB Elimination

Jamaica should be able to meet the timelines set by the Stockholm Convention for elimination of articles containing > 50 mL PCBs in concentrations > 50 ppm. This assertion is based on the JPSCo's active program of identification and collection for disposal of PCB-containing equipment. There is also high awareness of the Convention timelines in the public sector, with development of a management plan for speedy elimination of PCB-containing electrical equipment in the transmission and distribution systems, and updating of Jamaica's PCB Management Guideline being proposed as short/medium term policy implementation actions in the *National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper)*.

### 2.3.3 ASSESSMENT OF POP-PBDES (ANNEX A, PART IV AND PART V), HBB (ANNEX A, PART I) AND HBCD (ANNEX A, PART I AND PART VII)

#### 2.3.3.1 Introduction – POPs Flame Retardants

Flame retardants are chemicals that are applied to materials to prevent the start or slow the growth of fires. They have been used in many consumer and industrial products since the 1970s to decrease the ability of materials to ignite.

The Conference of the Parties amended the Stockholm Convention to add five brominated flame retardants (BFRs) to Annex A, listed below in order of year of addition to the Convention.

- Hexabromobiphenyl – HBB (2009)
- Hexabromodiphenyl ether and heptabromodiphenyl ether (2009)

(the commercial product is a mixture containing these two ethers, known as c-octabromodiphenyl ether)

- Tetrabromodiphenyl ether and pentabromodiphenyl ether (2009)
  (the commercial product is a mixture containing these two ethers, known as c-pentabromodiphenyl ether)
- Hexabromocyclododecane – HBCD (2013)
- Decabromodiphenyl ether – c-decaBDE (2017)

*Hexabromobiphenyl (HBB)* was applied as a flame retardant in three main commercial products: acrylonitrile-butadiene-styrene (ABS) thermoplastics used for business machine and motor housings; polyurethane (PUR) foam for automotive upholstery; coatings and lacquers. HBB was produced in relatively small quantities, used on a limited scale, and production ceased in 1976. Under the Convention, production and use are not allowed. The products and articles containing this substance are no longer in use and wastes are deemed to be not significant. This chemical is of minor relevance for the inventory process in many countries, and HBB and HBB-containing articles are not mentioned further in this assessment.

*c-Octabromodiphenyl ether (listed as the POP hexabromodiphenyl ether and heptabromodiphenyl ether)* was incorporated in ABS thermoplastics used for computer and TV casings (accounting for 95% of use) and other office equipment. It was also added to high-impact polystyrene (HIPS) polybutylene terephthalate (PBT) and polyamide plastics used in fabrication of office equipment, household appliances, connectors in vehicles, piping, and some textiles. Production ceased in 2004. Under the Convention, production is not allowed and use is restricted to recycling; the year for final disposal, in an environmentally sound manner (ESM), is 2030.

*c-Pentabromodiphenyl ether (listed as the POP tetrabromodiphenyl ether and pentabromodiphenyl ether)* was used mainly in PUR foam for cushioning material, accounting for 90-95% of use; of this, 36% is estimated to have been for the transport sector, 60% in furniture and 4% other uses. Production ceased in 2004. Under the Convention, production is not allowed, use is restricted to recycling, and disposal is required by 2030.

*Hexabromocyclododecane (HBCD)* is added to expanded polystyrene (XPS) and extruded polystyrene (EPS) used in buildings. It has been largely replaced by other flame retardants. Under the Convention, production is allowed for listed Parties, and use of XPS and EPS containing HBCD in buildings is allowed with the condition that the HBCD-containing XPS and EPS is easily

identified by labelling or other means throughout its life cycle.

*c-Decabromodiphenyl ether* is added to polymers used in parts for vehicles, plastic housings for heating home appliances (irons, fans), mobile phones, fax machines. It is also incorporated in PUR foam, and in the polymers for back-coating of textiles that require anti-flammable characteristics (excluding clothing and toys). The Convention requires elimination of production and use – with the exemption of parts for legacy vehicles; this exemption will expire in 2036.

#### 2.3.3.2 Results of the POP-PBDE Inventory

Detailed estimates of quantities of brominated flame retardants, the POP-BDEs, were conducted for the EEE/WEE and transport sectors using the prescribed methods.[3] Results indicate that large quantities of these POPs are present in stockpiles and waste, and have likely accumulated in municipal disposal facilities. Upholstered furniture, mattresses and textiles imported from jurisdictions with flammability standards constitute a further source of POP-PBDEs that was not assessed in this inventory.

For the EEE/WEEE sector, quantities of c-octaBDE estimated are shown below.

| | | |
|---|---|---|
| c-octaBDE imported/annum in EEE | 10,186 | kg |
| c-octaBDE in stockpiled EEE | 12,360 | kg |
| c-octaBDE in EEE entering the waste stream annually | 2,051 | kg |
| c-octaBDE in WEEE exported since June 2018 | 6.9 | kg |
| c-octaBDE in casings of CRT monitors and television sets (Tier I calculation) | 10,178 | kg |
| c-octaBDE in casings of CRT monitors and television sets (Tier III calculation) | 7,680 | kg |

The quantities of the actual listed POPs, hexaBDE and heptaBDE, were calculated using the known proportions of these homologues in c-octaBDE. These quantities are shown in Table 2.9 below.

**Table 2.9: POP-PBDE homologues present in EEE and WEEE**

| Homologues | Distribution of homologues in c-octaBDE | POP-PBDEs in import for inventory year 2020 (kg) | POP-PBDEs stockpiled for inventory year 2020 (kg) | POP-PBDEs entering the waste stream (kg) | POP-PBDEs in exported polymers (kg) | POP-PBDEs in CRT plastic casings in households† (Tier III) (kg) |
|---|---|---|---|---|---|---|
| Inventoried c-octaBDE | | 10,186 | 12,361 | 2,051 | 6.9 | 7,680 |
| **hexaBDE** | 11% | 1,121 | 1,360 | 226 | 0.8 | 845 |
| **heptaBDE** | 43% | 4,380 | 5,315 | 882 | 3.0 | 3,302 |
| octaBDE** | 35% | 3,565 | 4,326 | 718 | 2.4 | 2,688 |

**Not listed as a POP-PBDE in the Convention and therefore excluded from reporting.

†Subset of stockpiled POP-PBDEs (based on survey data)

Estimated quantities of c-pentaBDE in the transport sector are shown below

| | | |
|---|---|---|
| c-pentaBDE in vehicles imported 1975-2004 (total) | 9,463 | kg |
| c-pentaBDE in vehicles currently in use | 2,514 | kg |
| c-pentaBDE in end-of-life vehicles | 6,975 | kg |
| c-pentaBDE in vehicles in used car lots | 2.4 | kg |

Results of the calculations to the listed POP-PBDEs, using the known proportions of the homologues present in c-pentaBDE are shown in Table 2.10 below.

**Table 2.10: Listed POP-PBDE homologues (tetraBDE, pentaBDE, hexaBDE and heptaBDE) present in the transport sector for the life cycle stages of motor vehicles**

| Homologues | Distribution of homologues in c-pentaBDE | POP-PBDEs imported in vehicles 1975-2004 (kg) | POP-PBDEs in end-of-life vehicles in the inventory year 2020 (kg) | POP-PBDEs in vehicles currently in use in 2020 (kg) | POP-PBDEs in vehicles in used car lots (kg) |
|---|---|---|---|---|---|
| Inventoried c-pentaBDE | | 9,463 | 6,975 | 2,514 | 2.37 |
| **tetraBDE** | **33%** | **3,123** | **2,302** | **830** | **0.78** |
| **pentaBDE** | **58%** | **5,489** | **4,046** | **1,458** | **1.37** |
| **hexaBDE** | **8%** | **757** | **550** | **201** | 0.19 |
| **heptaBDE** | 0.5% | 47 | 35 | 13 | 0.012 |

Estimates of decabromodiphenyl ether in imported EEE were made using import data for 2002-2003 and 2016-2019 and the factors provided in UNEP Preliminary draft guidance on preparing inventories for this POP.[17] Results are shown in Table 2.11.

**Table 2.11: c-DecaBDE content in EEE imported annually**

| Relevant EEE | c-DecaBDE content in plastics (kg) |
|---|---|
| Heating appliances | 24.24 |
| Small household appliances | 5.16 |
| ICT equipment. w/o monitors | 113.23 |
| CRT monitor casings | 403.2 |
| Consumer equipment w/o monitors | 12.3 |
| Flat screen TVs (LCD) | 11.19 |
| **Total** | **569.32** |

Technical information provided by a major manufacturer of expanded polystyrene products demonstrated that the flame retardant in the beads imported as raw material is not HBCD or any other POP listed to the Convention.

#### 2.3.3.3 Methodology, Assumptions and Limitations – POP-PBDEs

c-OctaBDE in the EEE/WEEE Sector

A. *Estimate of c-OctaBDE in Imported EEE*

1. Import data for items classified in WEEE categories 3 and 4 for the years 2002-2003 was obtained and sorted into the following subcategories.
   - WEEE category 3
     - ICT equipment without monitors
     - CRT computer monitors
   - WEEE category 4
     - Consumer equipment without monitors
     - CRT TVs
2. (a) It was assumed that:
   i. POP-PBDEs are used in second-hand articles only, not new articles;
   ii. 10% of imports are second-hand.

   A factor of 0.1 was therefore applied to the weights of imports in each subcategory in A.1. above.

   (b) Other factors applied to the weights of imports in each subcategory were:
   i. polymer fractions;
   ii. concentrations of c-octaBDE

   as prescribed by the guidance document.

B. Estimate of c-OctaBDE in EEE Stockpiled in Households and Institutions

1. Weights of EEE in each of the four subcategories in A.1. above were obtained from limited surveys of EEE in households and statistical data on number of households and the size of the workforce.
2. The factors indicated in A.2.(b) above were applied to the weights of EEE in each subcategory.

C. Estimate of c-OctaBDE in EEE Entering the Waste Stream

1. From NSWMA waste classification data, the total weight of EEE going into the waste stream was taken as 18,309 t/a.

2. This was sorted into the four subcategories in A.1. above using percentages from the report [STATIN REPORT (VNR 2018 Statistical Annex)]

- WEEE category 3
  - ICT equipment without monitors (38%, 6,958 t)
  - CRT computer monitors (4%, 732 t)
- WEEE category 4
  - Consumer equipment without monitors (47%, 8,605 t)
  - CRT TVs (11%, 2,014 t)

The factors indicated in A.2.(b) above were applied to the weights of EEE in each subcategory.

D. *Estimate of c-OctaBDE in WEEE Entering the Waste Stream*

1. The weight of WEEE exported 2018-present was obtained from NEPA
2. The total quantity was sorted into the four relevant subcategories using the waste percentages shown in C.2 above, and the factors indicated in A.2.(b) above were applied to the weights of WEEE in each subcategory.

<u>c-PentaBDE in the Transport Sector</u>

A. *Estimate of c-PentaBDE in Imported Vehicles, 1975-2004*

1. An estimate of the numbers of cars, trucks and buses imported to Jamaica 1975-2004 was made, using import data for 2002-2003.
2. The factors provided in the guidance document relating to country of origin, quantity of c-pentaBDE in PUR foam per car, truck or bus, were applied to each category of vehicle and the total quantity of c-pentaBDE calculated.

B. *Estimate of c-PentaBDE in Vehicles in Use and for Sale*

1. Numbers of cars, trucks, buses in use (registered) with model years 1975-2004 were obtained from the Ministry of Transport and Mining, and calculations as per A.2. above yielded the quantity of c-pentaBDE in vehicles in use.
2. An estimate of the numbers for sale in each category (car, truck, bus) was obtained from Jamaica Used Car Dealers Association and the requisite calculations carried out.

C. *Estimate of c-PentaBDE in End-of-Life Vehicles*

1. The difference between the number of vehicles in each category in A.1 and the number of vehicles in each category in B.1 was taken as the number of ELVs;

   for example, (number of buses imported 1975-2004) – (number of buses in use with model years 1975-2004) = number of buses reaching end of life.

2. The factors provided in the guidance document relating to country of origin, quantity of c-pentaBDE in PUR foam per car, truck or bus, were applied to each category of vehicle and the total quantity of c-pentaBDE calculated.

### 2.3.4 ASSESSMENT OF HEXACHLOROBUTADIENE – HCBD (ANNEX A, PART I)

Hexachlorobutadiene (HCBD) is formed as a by-product in the manufacture of chlorinated solvents; this industrial process does not take place in Jamaica. The intentional manufacture of this POP ceased in the 1970s. The only likely local occurrence, based on the known applications, is in transformer oil. Going forward, analyses of oil from older transformers should include determination of HCBD content (see section 3.3.2).

### 2.3.5 ASSESSMENT OF DICHLORODIPHENYLTRICHLOROETHANE (DDT) (ANNEX B, PART II)

While there has been recent incidence of malaria in Jamaica (280 cases in 2006/2007 and two imported cases in 2019), vector control measures have not entailed use of DDT. Under the Pesticides Act, 1975, importation of this pesticide has been prohibited since 1999 and, based on import records, there have been no exceptions 2006-present.

### 2.3.6 ASSESSMENT OF PFOS, ITS SALTS AND PFOSF (ANNEX B, PART III) AND PFOA, ITS SALTS AND PFOA-RELATED COMPOUNDS (ANNEX A)

#### 2.3.6.1 Introduction – PFOS, PFOA

Strictly defined, PFOS is perfluorooctane sulfonic acid. In most applications, salts, polymers or other derivatives are used. In the 2007 OECD estimate, 165 PFOS-derived substances had been used in various applications.[19] In some legal contexts the term "PFOS" refers to the substance group – all substances that incorporate the $C_8F_{17}SO_2$ structural element. In this document, PFOS is used to designate any compound in the substance group. PFOA is perfluorooctanoic acid. Most applications also entail salts, polymers or other derivatives. In this document "PFOA" refers to the substance group – any chemical that incorporates the $C_7F_{15}CO$- residue. The derivatives of PFOS and PFOA used in the various applications can degrade to the acids in the environment, or by metabolism in living organisms.

PFOS and PFOA derivatives are lipid-repellent and water-repellent and have been used as surface-active agents in many applications. Because of the strong carbon-fluorine bonds, these substances are very stable, and therefore suitable for purposes that entail high temperatures and contact with strong acids and bases. The main applications of PFOS and PFOA are listed in Table 1.1.

Both PFOS and PFOA have been used commercially for more than 60 years. Global production of PFOS decreased significantly after 2000 and is now estimated at 20 t/a. For PFOA, production up to 2012 was known to be 90 t/a. The major task is managing the legacy of the cumulative production and use.

Firefighting foams with fluorosurfactants such as PFOS/PFOA are used to extinguish and suppress Class B fires; these are fires caused by flammable liquids – both water-insoluble substances like oil, petrol and other hydrocarbons, and water-soluble liquids such as acetone and alcohols. This dispersive application of a POP-containing product results in high releases to the environment and is of great concern globally. Currently, most firefighting foams are manufactured without PFOS; PFOA was for some time used as a replacement for PFOS. There are significant amounts of firefighting foams containing PFOS stored, as firefighting foams have a long shelf life (10–20 years or longer).

PFOS, the acid, its salts and perfluorooctane sulfonyl fluoride were listed in Annex B (for restricted use) of the Convention in 2009. PFOS production should have ended in 2019; currently, PFOS may be used for the following applications:

- to make insect bait (not applicable to Jamaica)
- for hard metal plating (likely not applicable to Jamaica)
- for firefighting foam, subject to the following conditions
  - not to be imported or exported, except for disposal
  - not to be used for training
  - not to be used for testing, unless releases are contained
  - efforts should be made to eliminate the use of these foams by 2024f
  - efforts should be made to manage firefighting foam stockpiles and wastes

PFOA, the acid, its salts and PFOA-related compounds were listed in Annex A of the Convention (for elimination) in 2019. General production should have ended in 2020. However, some Parties have registered to continue production for some critical applications (6).[1] These include coatings for textiles in some high-risk applications and medical devices and pharmaceutical products. Use of firefighting foam containing PFOA may continue subject to the same conditions as those that apply to PFOS-containing foam, except that the year of elimination can be extended to 2025.

#### 2.3.6.2 PFOS and PFOA in the Jamaican Context

The PFOS and PFOA present in Jamaica have been imported as additive components in the products and consumer articles listed in Table 1.1. PFOS is also classified as a pesticide; in this application, a PFOS derivative is used in the preparation of sulfluramid for control of *Atta and Acromyrex* leaf-cutting ants, neither of which are pests in Jamaica, and sulfluramid is not registered for use in Jamaica. There are no known electronics, semiconductor or photographic industries that use the materials, and it is unclear if the hard metal plating application is practised in Jamaica. Since the closure of Air Jamaica, there is no commercial airline based in Jamaica and in-country aircraft maintenance activity is minimal, so volumes of aviation hydraulic fluids used and disposed of are low. Locally, most PFOS and PFOA are likely to be found in stored firefighting foam concentrate.

*Firefighting Foam* - A list of entities with firefighting capability and those that might stock or retail foam was generated. A questionnaire based on the UNEP firefighting foam inventory form[5] was administered to personnel in these entities. Thirteen entities received questionnaires and ten sent responses.

One major stakeholder in this group pointed out the security risk attendant to disclosing and circulating information on quantities of firefighting foam in stock. This stakeholder provided qualitative information on the types of foam. Based on this stakeholder's reservation, a valid one, responses linking quantities of foam with the identities of organizations are held confidentially.

Import data from STATIN was also collected. Items imported under the tariff code "3813000000 – preparations and charges for fire extinguishers; charged fire extinguishing grenades" are not disaggregated by dry chemicals or foam concentrates, so it was not possible to determine which of these contain PFOS, PFOA, or any PFAS and therefore this data was not used in the inventory.

Findings of the inventory

1. Information on the brands and types of foam concentrate (used for Class B fires) stocked by the ten respondents is summarized in Table 2.12.
   (a) Seven (7) brands and approximately 21 products were found to be in stock.
   (b) Seven products could be established as free of PFOS or PFOA.
   (c) Ten products contain either PFOS or PFOA.
   (d) For four (4) products, insufficient information was supplied to determine if PFOS or PFOA is present.
   (e) Assuming that:
      (i) the foams in (d) above contain PFOS or PFOA, a minimum quantity of 29,140 kg foam contains these POPs
      (ii) the concentration of PFOS of PFOA in foam is 1.5% w/w, and the amount of PFOS + PFOA in stored firefighting foam in Jamaica could be in excess of **29,140 x 0.015 kg = 437 kg**

2. Four of the ten respondents provided information on the use of firefighting foam in training and actual fire events; of these four, one reported disposing of foam at a municipal facility (with approval from NEPA).
   (a) Training using foam concentrate is reported to have been carried out at 17 locations; there were no details for 13 of these locations; follow-up with the stakeholders will be required.
   (b) Actual significant fire events over the past 20 years requiring use of foam number about 14; again, follow-up with stakeholders is needed.

3. As indicated in 1 and 2 above, a number of the responses were not complete.

4. The issue of PFOS and PFOA in firefighting foam seemed to be unfamiliar to the stakeholders who received the questionnaire; this may partly explain the slow and incomplete responses.

**Table 2.12: Firefighting foam concentrate stocked by ten respondents**

| | Foam | Comments | No. of entities holding foam | Total in stock (kg) |
|---|---|---|---|---|
| 1 | Angus Fire, UK<br>Tridol C6 S3 AFFF (3%)<br>Labelled $C_6$ foam | According to the SDS provided this foam contains PFOA<br>https://www.firefightingfoam.com/assets/Uploads/SALES-SHEETS/5162-Tridol-C6-S3.pdf | 2 | 16,428 |
| 2 | Angus Fire 3-6%<br>Alcoseal AR FFFP<br>Assume C6 | No PFOS or PFOA, according to the current SDS (online); this may not apply to the foam held by the local entity<br>*"Our C6 foams contain no PFOA and no PFOS, in accordance with US EPA Stewardship Programme 2010/15 and EU Directive 2006/122/EC and amended Council Directive 76/769/EEC"* | 1 | 1,380 |
| 3 | Angus Fire<br>6% Petroseal-FFFP<br>Assume C6 | No PFOS or PFOA, according to the current SDS (online); this may not apply to the foam held by the local entity<br>*"Our C6 foams contain no PFOA and no PFOS, in accordance with US EPA Stewardship Programme 2010/15 and EU Directive 2006/122/EC and amended Council Directive 76/769/EEC"* | 1 | 975 |
| 4 | Ansul 55809<br>Ansulite 3% AFFF<br>(AFC-3A) | This foam likely contains PFOS or PFOA. Text from seller's webpage:<br>***Q: What is the difference between AFC-3-A and AFC-3-B***<br>*A: Please review the two data sheets below.*<br>*The key difference is that the AFC-3-B is the environmentally mindful concentrate formulation which contains short-chain C-6 fluorochemicals. The AFC-3-A Is still available but some states require the use of the more environmentally friendly foam in which case you would use the AFC3B formulation. Please check with your local AHJ to determine if you need the environmentally mindful foam.*<br>Both data sheets were downloaded. | 1 | 210 |

| | Foam | Comments | No. of entities holding foam | Total in stock (kg) |
|---|---|---|---|---|
| 5 | Buckeye 50340<br>Platinum 3% AFFF | Buckeye legacy foam; doesn't specify $C_6$<br>http://buckeyefire.com/wp-content/uploads/2018/12/Platinum-3-AFFF.pdf | 2 | 385 |
| 6 | Buckeye 50345 Platinum 3% AFFF | Buckeye legacy foam; doesn't specify C6<br>All current Buckeye foams specify C6 | 1 | 215 |
| 7 | Buckeye 56340 Platinum 3% AFFF | Buckeye legacy foam; doesn't specify C6<br>All current Buckeye foams specify C6 | 1 | 147 |
| 8 | Buckeye Platinum 3% AR AFFF | Not enough information supplied by respondent to determine if this is a current or legacy foam | 1 | 1,102 |
| 9 | Buckeye 3-6% AR AFFF | Not enough information supplied by respondent to determine if this is a current or legacy foam | 1 | 202 |
| 10 | Chemguard C3B 3% AFFF | Evidently no PFOS or PFOA; statement from website below<br>*"The environmentally-mindful CHEMGUARD C3B 3% AFFF Concentrate formulation contains short-chain, C-6 fluorochemicals manufactured using a telomer-based process. The telomer process produces no PFOS, and these C-6 materials do not break down to yield PFOA. The fluorochemicals used in the concentrate meet the goals of the U.S. Environmental Protection Agency 2010/15 PFOA Stewardship Program."* | 1 | Not disclosed |
| 11 | Chemguard C364 3-6% AR AFFF | This is a C6 foam; text from TDS below<br>*"The CHEMGUARD C364 3×6 AR-AFFF Concentrate formulation contains short-chain, C-6 fluorochemicals manufactured using a telomer-based process that does not produce PFOS."* | 2 | 1,653 |

| | Foam | Comments | No. of entities holding foam | Total in stock (kg) |
|---|---|---|---|---|
| 12 | Chemguard C3IB2 3% AFFF; genuine C6 foam | http://interamsa.com/downloads/CHEMGUARD-C3IB2-3-percent-AFFF.pdf<br>Evidently no PFOS or PFOA; statement from website below<br>*"The environmentally mindful CHEMGUARD C3B 3% AFFF Concentrate formulation contains short-chain, C-6 fluorochemicals manufactured using a telomer-based process. The telomer process produces no PFOS, and these C-6 materials do not break down to yield PFOA. The fluorochemicals used in the concentrate meet the goals of the U.S. Environmental Protection Agency 2010/15 PFOA Stewardship Program."* | 1 | 7,667 |
| 13 | Chemguard<br>3-6% AR AFFF | Not enough information to determine presence or absence of PFOS/PFOA; may be the same as one of the previously listed Chemguard foams | 1 | 646 |
| 14 | Chemguard<br>3% AR AFFF | Not enough information to determine presence or absence of PFOS/PFOA; may be the same as one of the previously listed Chemguard foams | 1 | 918 |
| 15 | Germania Feuerschutz 68542<br>AFROSYNT M-5 3% | European foam; likely fluorine free; SDS does not indicate PFAS<br>https://www.fwp.fi/pub/media/rauplan/productdownloads//m/s/msds_afrosynt_m-5_en.pdf | 1 | 275 |
| 16 | National Foam<br>AER-O-LITE from picture of label provided by respondent | The label doesn't specify $C_6$, so $C_8$ is assumed.<br>The current Aer-O-Lite foams on the National Foam website are labelled "Aer-O-Lite$^{TMC6}$" | 1 | 146 |
| 17 | National Foam<br>Aer-O-Lite 3% AFFF | Contains PFOA, according to the SDS | 1 | 2,589 |

| Foam | | Comments | No. of entities holding foam | Total in stock (kg) |
|---|---|---|---|---|
| 18 | National Foam Universal Gold 1%/3% AR- AFFF | https://nationalfoam.com/wp-content/uploads/sites/4/NFC420-Universal-Gold-1-3-AR-AFFF.pdf<br>"no PFOS" stated; Fluoroalkyl Surfactant, CAS number confidential, 0.5-2%.Labelled $C_6$ foam, but contains PFOA according to the SDS | 2 | 6,152 + an un-disclosed quantity |
| 19 | National Foam Universal Gold AR AFFF | Contains PFOA, according to the SDS | 1 | Not disclosed |
| 20 | National Foam Aer-O-Foam XL3 FFFP | Contains PFOA, according to the SDS | 1 | Not disclosed |
| 21 | Oil Technics Ltd Aberdeen 3% AFFF-C6 | genuine C6 foam | 1 | 2,910 |

*Synthetic Carpets* Quantities of PFOS in waste and in carpets in use were estimated as described below.

A. *Assumptions*

1. From an EU study:[5]
   (a) the estimated average concentration of PFOS in carpets = **75 ppm;**
   (this takes account of the fact that not all carpets are treated with PFOS);
   (b) the lifetime of synthetic carpet = **14 years.**
2. (a) Average **total** annual imports to Jamaica of synthetic carpets = **178,400 kg**

This average will apply up to 2002, which was when most uses of PFOS in goods produced in the USA ceased.

(b) Avg annual imports to Jamaica of synthetic carpets
**from Asia = 71,860 kg**

These averages are based on 2006-2018 data.[17]

B. ***Estimates***

1. Annual imports of PFOS in carpets in the years up to 2002

$$= \frac{178{,}400 \times 0.075 \text{ kg}}{1000} = \textbf{13.38 kg}$$

2. Annual imports from Asia of PFOS in carpets after 2002

$$= \frac{71{,}860 \times 0.075 \text{ kg}}{1000} = \textbf{5.39 kg}$$

3. (a) Carpets imported 1976-2002 (27 years) would have entered the waste stream 1990-2016

PFOS entering waste stream 1990-2016 = 27 x 13.38 kg
= **361.26 kg**

(b) Carpets imported 2003-2006 (4 years) would have entered the waste stream 2017-2020

PFOS entering waste stream 2017-2020 = 4 x 5.39 kg
= **21.56 kg**

(c) Total PFOS entering waste stream 1976-2020 = **(361.26 + 21.56) kg**
= **383 kg**

(d) PFOS in synthetic carpets in use, 2007-2020 (14 years)

= 14 x 5.39 kg

= **75.5** kg (upper limit)

*Upholstered Furniture* Import statistics were collected for upholstered furniture (934,718 kg/ year) with a view to estimating PFOS content in these articles. Further study revealed that PFOS is actually used to treat high-end leather upholstery for furniture and cars.[6] Leather upholstery is not disaggregated in the import figures for upholstered furniture. Given that (a) leather-covered furniture and car upholstery would constitute a very small percentage of imports to Jamaica and (b) PFOS concentration would be 80 ppm in treated articles, it was concluded that insignificant quantities of PFOS are imported in upholstery.

### 2.3.7 ASSESSMENT OF RELEASES OF UNINTENTIONALLY PRODUCED CHEMICALS (ANNEX C)

#### 2.3.7.1 Introduction – UPOPs

Unintentional POPs (also referred to as UPOPs) are unintentionally formed and released to air, land and water from thermal processes involving organic matter and chlorine as a result of incomplete combustion or chemical reactions.

These seven chemicals, named below, are listed in Annex C pursuant to Article 5 of the Convention.

- Polychlorinated dibenzo-p-dioxins (PCDD)
- Polychlorinated dibenzofurans (PCDF)
- Polychlorinated biphenyls (PCB)
- Hexachlorobenzene (HCB)
- Pentachlorobenzene (PeCBz)
- Polychlorinated naphthalenes (PCNs)
- Hexachlorobutadiene (HCBD)

The goal is the continuing minimization and, where feasible, ultimate elimination of the total releases of these chemicals derived from anthropogenic sources. PCDD and PCDF (collectively referred to as PCDD/PCDF) have never been used as commercial products, or intentionally manufactured for any reason other than laboratory purposes. They are the only POPs listed only in Annex C. The other UPOPs, all with other applications, are formed largely from the same sources as PCDD/PCDF. Therefore:

- the presence of PCDD/PCDF is indicative of the presence of other UPOPs;
- measures for reduction or elimination of PCDD/PCDF will reduce or eliminate the other UPOP;
- the recommendation from the Convention guidance is that, for practical purposes, a UPOP inventory should focus on PCDD/PCDF, as this will form an adequate basis for prioritization of sources for control measures applicable to all Annex C POPs.

#### 2.3.7.2 Results of the UPOPs Inventory

A national emissions inventory of UPOPs was carried out in September-December 2020 using the prescribed methods.[6] Results, shown in Table 2.13 below, reveal that most UPOPs are released in residue, followed by releases to air and land.

The actual quantities calculated are subject to some uncertainty due to insufficient or poor-quality data and the necessity for a number of assumptions. The calculations indicate that the total amount of PCDD/PCDF released annually is 254 g TEQ and that the largest contribution is from disposal residues that are associated with wastewater treatment plants primarily. PCDD/PCDF releases to air from waste incineration, production of mineral products and transportation are significant. The contribution to emissions to air from heat and power generation is small but the open-burning processes are relatively high contributors to air and to a lesser extent land. The

PCDD/PCDF contribution from production of chemical and consumer goods which includes petroleum refining (flares) and Miscellaneous which includes tobacco smoking, dry cleaning and crematoria were too low to register any values in the inventory calculations.

**Table 2.13: Annual releases of UPOPs in Jamaica**

| | Source Groups | Annual Releases (g TEQ/yr) | | | | |
|---|---|---|---|---|---|---|
| Group | | Air | Water | Land | Product | Residue |
| **1** | Waste Incineration | 2.2 | 0.0 | 0.0 | 0.0 | 0.6 |
| **2** | Ferrous and Non-Ferrous Metal Production | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **3** | Heat and Power Generation | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 |
| **4** | Production of Mineral Products | 3.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| **5** | Transportation | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| **6** | Open Burning Processes | 15.0 | 0.0 | 1.2 | 0.0 | 0.0 |
| **7** | Production of Chemicals and Consumer Goods | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **8** | Miscellaneous | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **9** | Disposal | 0.0 | 0.5 | 0.0 | 0.0 | 229.2 |
| **10** | Identification of Potential Hot-Spots | | | | 0.0 | 0.0 |
| **1-10** | **Total** | **22.5** | **0.5** | **1.2** | **0.0** | **230.0** |
| | **GRAND TOTAL** | | | **254** | | |

*Differences are due to rounding*

**Figures 9 and 10 are graphical representations of the emissions of dioxins and furans.**

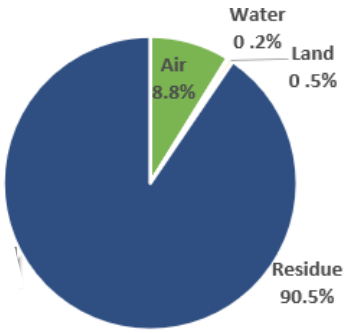



**Figure 9: Releases of dioxins and furans by media**

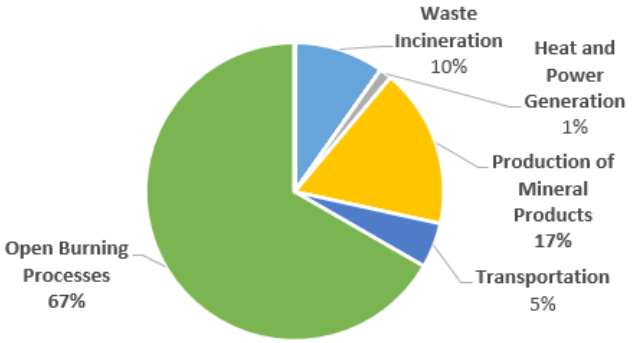



**Figure 10: Distribution of releases of dioxins and furans to air**

### 2.3.7.3 Methodology, Assumptions and Limitations – UPOPs

Methods employed in the data gathering exercise included contact with public sector agencies and private sector companies by telephone and email. The aim was to collect 2019 data for this inventory. However, due to difficulty obtaining 2019 data, the latest available data was used in many cases and extrapolated where deemed necessary. In a few cases, averages of data for two or three years were used. There was a specific constraint with data from the population census. The last census conducted was in 2011. The next census is currently underway and will be conducted.

Group 1 – Waste Incineration

*Municipal Solid Waste* – Calculations are based on waste incinerated by two entities that burn large quantities of municipal waste. The annual quantity of waste burned was assumed to be 1,544 t, releasing 2.002, 0.540, and 0.051 g TEQ/yr of PCDD/PCDF to air, fly ash and bottom ash respectively.

*Medical Waste* – Data from three medical waste incinerators operated by the MOHW and one private entity indicated that approximately 105 t/yr medical waste is incinerated, releasing 0.203, 0.041, and 0.001 g TEQ/yr of PCDD/PCDF to air, fly ash and bottom ash respectively.

*Animal Carcasses* – For this subcategory, it was not possible to aggregate the number of dead animals burnt since much of this is done on an ad hoc basis and dispersed across several private farming establishments. The information obtained for the inventory was therefore only for a pet crematorium, (12 t/a) for which releases are negligible.

Group 2 – Heat and Power Generation

*Fossil Fuel Power Plants* – Data on petroleum consumption was obtained from the Ministry of Science, Energy and Technology's Jamaica Energy Statistics for 2019 (preliminary). The data on annual consumption by activity, product, and alternative fuels were used to calculate the fossil fuel consumption (45,957 TJ/a) which emits 0.102 g TEQ/a of PCDD/PCDF to air.

*Biomass Power Plants* – For this category, national data on bagasse consumption was obtained from the Ministry of Science, Energy and Technology's Jamaica Energy Statistics for 2019 (preliminary) for Jamaica's Total Alternative Energy Consumption. The BOE for bagasse was 325, 000, equivalent to 1,988 TJ which on combustion releases 0.099 and 0.1 g TEQ/yr to air and residue respectively. It was assumed that all bagasse reported as being consumed was for firing boilers and/or power generation.

*Household Heating and Cooking, Domestic Heating, Fossil Fuels* – The 2011 census data from STATIN indicated that LPG, electricity, wood, charcoal and kerosene were the primary sources of fuel for cooking, with LPG accounting for the largest share (80.5%). STATIN data is for numbers of households, not quantities of fuel. Information was available for quantities of LPG and kerosene used for cooking and lighting from MSET's Jamaica Energy Statistics for 2019 (preliminary). For the UPOPs inventory, the sum of the energy from LPG and kerosene used for cooking and lighting 7,355 TJ/a, from the MSET data was applied; this emits 0.012 g TEQ/yr

PCDD/PCDF to air. The MSET data did not include the amount of wood and charcoal utilised on an annual basis for cooking so it was not possible to calculate emissions from household heating and cooking using biomass.

Group 3 – Production of Mineral Products

*Cement Kilns* –The Caribbean Cement Company Limited (CCCL), the main cement manufacturer in Jamaica provided data on average annual production for 2018 and 2019 (774,000 t) which correlated well with figures from STATIN. Based on this activity, emissions of PCDD/PCDF to air were 3.870 g TEQ/yr. Of the four (4) categories below presented as options in the Toolkit for categorisation of the type of kiln, CCCL's kilns do not readily fit into any of the categories.

1. Shaft kilns
2. 2 old wet kilns, ESP temperature >300 °C
3. Wet kilns, ESP/FF temperature 200 to 300 °C
4. Wet kilns, ESP/FF temperature <200 °C and all types of dry kilns with preheater/precalciner, T< 200 °C

The closest category is #4 "…and all types of dry kilns with preheater/precalciner…" but CCCL's kilns have temperature ranges of 1250 – 1450 °C.

*Lime* – CEMEX Jamaica, the only lime producer in CARICOM, produces and sells quicklime to the alumina industry and they also operate a hydrated lime plant. For the inventory calculations, the average of 2018 and 2019 production figures (91,254 t), provided by the company, was used; this yields PCDD/PCDF emissions to air of 0.006 g TEQ/a. CEMEX Jamaica indicated that the pollution abatement equipment used at the facility is a dust collector/ Bag House Filtration system.

*Asphalt Mixing* – All asphalt used in Jamaica is sourced from Petrojam, the country's oil refinery. The data used in the inventory calculations was the preliminary 2019 asphalt consumption (21,026 t/a) contained in the Jamaica Energy Statistics. Petrojam employs the use of pollution abatement equipment for their emissions. The release of PCDD/PCDF to residue was 0.001 g TEQ/yr.

*Group 4 – Transport*

The following results were obtained for this activity.

| Engines | Consumption | Annual release |
|---|---|---|
| | t/yr | g TEQ/yr |
| | | Air |
| 4-stroke gasoline | 582,254 | 0.001 |
| 2-stroke gasoline | 3,147 | 0.008 |
| Diesel | 299,035 | 0.030 |
| HFO | 513,069 | 1.026 |

Activity data for the calculations was drawn from two sources: vehicle type and fuel use from the Island Traffic Authority (ITA) 2019 roadworthiness database, and fuel consumption data contained in the Jamaica Energy Statistics published by MSET. The quantity of fuel used by diesel motor vehicles was obtained by subtraction of the amount of unleaded gasoline from the total fuel consumption for the road and rail category. Indications are that no motor vehicles use HFO. Fossil fuel consumed by the shipping sector (513,068.7 t) in MSET's statistics is HFO.

*Group 5 – Open Burning Processes*

*Biomass Burning* – The previous inventory included burning of cannabis fields as a source of emissions from biomass burning. Cannabis fields are no longer burned due to the decriminalisation of cannabis in 2015, therefore this source does not contribute to this inventory. The following results were obtained for biomass burning. Major inputs are from agricultural residues, grassland and savannah fires, forest fires and sugar cane burning.

| Production | Annual release | |
|---|---|---|
| t/a | g TEQ/a | g TEQ/a |
| | Air | Land |
| 5,700,650 | 2.909 | 0.854 |

The estimated land area cleared for agriculture by burning annually by registered farmers was 564,025 ha, but RADA could not provide the tonnes per ha of biomass burned. Estimates of biomass burnt/ha (fuel loads) and percentage of biomass burnt for different types of vegetation were based on literature values in other countries.[18] The areas and quantities of biomass burned in grassland and savannah fires and forest fires were estimated from information provided by the Jamaica Fire Brigade, FAO data, and a number of assumptions. Estimates of biomass burned in harvesting of sugar cane were based on information from the SIA and FAO data.

*Waste Burning and Accidental Fires* – Emissions from this category are summarized below.

| Production | Annual release | |
|---|---|---|
| t/a | g TEQ/a | g TEQ/a |
| | Air | Land |
| 301,561 | 12.062 | 0.302 |

*Fires at Waste Disposal Sites* – Jamaica has eight municipal disposal sites, none of which are engineered sanitary landfills, and all experience accidental fires from time to time. Causes of these fires include the disposal of hot material at the site, spontaneous combustion during drought and hot weather and, sometimes, informal sorters lighting fires in search of useful materials. Fires at the disposal sites historically were frequent, of long duration and covered large areas, but improved management of the sites in recent years has led to a reduction in the frequency, extent and severity of the fires. Information was available on the number and duration of the fires in 2017, 2018 and 2019. Critical data that was missing was the estimated amount of waste burned as that information is not recorded. **No inventory calculation could be done for this subcategory due to insufficient information.** This outcome is similar to the one for the 2005 Inventory as there is no credible basis for utilising information from developed countries to estimate the quantity of waste burnt in disposal site fires.

*Accidental Fires, Houses and Factories* – Information on the number of structural fires was available but there was no information on the quantity of material burnt or any other data to facilitate an estimation. **No inventory calculation could be done for this subcategory due to insufficient information.**

*Open Burning of Domestic Waste* - The most recent data on open burning collected in Jamaica was during the 2011 census. It is not expected that the prevalence of backyard burning has changed significantly since 2011 so that data was used.

- 2011 census data indicated that 266,514 households burned garbage
- 2011 census stated that average number of persons per household was 3.1
- NSWMA states that average per capita daily waste generation rate is 1 kg (365 days in a year)

These figures were used to compute the annual tonnage of domestic waste burned in the amount of 301,560.59 t/a. This correlates with the value (252,258.55 t/a) obtained by assuming that of total domestic waste generated (1,001,026 t/a), 30% is uncollected and 84% of uncollected

waste is burned. The higher figure was used since it is expected that there are more households in 2019/2020 and the prevalence of domestic garbage collection and open burning is not expected to have changed significantly.

Group 6 – Production and Use of Chemical and Consumer Goods

*Petroleum Refining* – The refinery in Kingston, Jamaica operates as a hydroskimming-type plant. A hydroskimming refinery is equipped with a main atmospheric distillation unit, a naphtha reforming unit and necessary treating processes for other products going to storage. Based on the refining process used at Petrojam, with the exception of flares, the other subcategories pertaining to the refining process were not applicable. Information on Petrojam's flares was obtained from the 2018 Annual Air Emissions Report submitted to NEPA. The flares were reported as 20,953 barrels of oil which were converted to TJ for use in the report. The amount was too low to register any PCDD/PCDF releases to air, water, land or in residues.

Group7 – Miscellaneous

*Crematoria* –Three crematoria are operating in Jamaica, and all are Class 3 (optimal control) where the combustion temperature is above 850 °C with controlled combustion airflow and air pollution control system (APCS) in operation. The average weight of a body for cremation is 65 kg. The inventoried quantities were too low to register any PCDD/PCDF releases to the environment.

*Dry Cleaning* – The average annual imports of tetrachloroethylene for 2015-2018 was calculated as 14.15 tonnes based on data obtained from STATIN. This figure was used to compute the number of residues (14.15 t/year) which was input into the Excel spreadsheet. All the tetrachloroethylene (perchloroethylene) solvent imported into Jamaica was assigned to the dry cleaning sector, and a 50:50 split between heavy textiles and normal textiles was assumed. This industry's contribution to UPOPs (0.022 g TEQ/a to residue) is considered to be negligible.

*Tobacco Smoking* – The Jamaica Customs Agency provided statistics on tobacco cigarettes imported in 2018 and 2019 as well as the tobacco cigarettes seized in 2018 and 2019. No adjustment to the total number of cigarettes imported could be made based on illegal sticks that may remain in the market for use, as this information was not available. For the calculations, the average of 2018 and 2019 Number of Tobacco Cigarettes imported was used. The contribution of this activity to UPOPs ($3.414 \times 10^{-5}$ g TEQ/a to residue) is negligible.

Group 8 – Disposal

*Landfills, Waste Dumps and Landfill Mining* – The following are the results for this activity.

| Production | Annual release |
|---|---|
| $m^3/a$ | g TEQ/a |
| | Residue |
| 1,001,026 | 50.051 |

The quantity of solid waste sent to Jamaica's eight municipal disposal sites for the period April 2019 to March 2020 from information provided by NSWMA is 1,001,026, and this was taken as an annual value. This solid waste comprises residential and light commercial;[23] although these disposal sites are not designed for industrial waste, some makes its way there. About 68% of the solid waste is residential while 32% is classified as commercial. The category that best describes the landfilled waste is Class 2 - landfilling of waste which may contain some hazardous components is labelled Mixed Wastes on the calculation spreadsheet.

*Sewage and Sewage Treatment* – The inputs and emissions for this subcategory are shown below.

| Production | Annual release | |
|---|---|---|
| t/a | g TEQ/a | g TEQ/a |
| | Water | Residue |
| 50,946,661 | 0.501 | 179.111 |

Information was received from NEPA, NWC and the South Eastern Regional Health Authority (SEHRA) on over 300 wastewater treatment plants. These were categorized by input, with and without sludge removal. In many instances, the data provided was poor or incomplete, and several assumptions had to be made with respect to sludge removal and effluent discharge volumes (often not stated).

When the data was entered into the Excel spreadsheet in litres (50,946,661,195) as required by the directive in the worksheet, the calculated values for this source category resulted in an extremely large quantity of residue in the amount of 179,110.5 g TEQ/a, which could not be

correct. If, however, the input data was in $m^3$, which is how it is presented in the UNEP Toolkit Guidance document, the values were more in line with what is expected. As such the data was entered as $m^3$. Many of the sewage treatment plants in Jamaica utilise land disposal and are therefore not the traditional treatment plants with a measurable effluent discharge. The UNEP Toolkit made a passing reference to wetland-type treatment systems but it did not appear to consider these types of treatment plants with sufficient detail. It may be that the emission factors recommended are not best suited for the types of treatment facilities that are prevalent in Jamaica.

*Composting* – In the 2011 census, data on the methods of household garbage disposal was collected but there was no category for composting. Since composting is not widely done on a commercial basis no information was obtained for this inventory.

*Waste Oil Disposal* – Most used oil that falls into the category of lubricants, heavy fuel oils and diesel, is processed and reused by industries for power and/or steam generation by mixing a portion with virgin fuel. To avoid double counting no data was included in the inventory calculations for this subcategory.

Group 9 – Contaminated Sites and Hotspots

There are no known contaminated sites or hotspots that would be sources of UPOPs.

### 2.3.8 INFORMATION ON THE STATE OF KNOWLEDGE ON STOCKPILES, CONTAMINATED SITES AND WASTES

#### 2.3.8.1 POPs Pesticides – Stockpiles and Contaminated Sites

There are no known stockpiles or contaminated sites with POPs pesticides as these were cleared and the materials exported for disposal under the regional GEF-funded project *Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean.*

#### 2.3.8.2 PCBs – Stockpiles and Contaminated Sites

The only known PCB stockpile is the well-secured storage facility, maintained by the JPSCo, for consolidation of decommissioned PCB equipment and contaminated material prior to export for disposal. Quantities are given in section 2.3.2.3.

Many large organizations in Jamaica have changed to LED lighting, and truckloads of obsolete FLBs have been discarded in municipal facilities at which fires are not infrequent occurrences. It is unclear if electrical waste is segregated from other waste at these facilities and if it is when this practice commenced. Municipal disposal facilities should therefore be considered to be PCB-contaminated sites, and the fires that occur at those locations constitute threats to human health and the environment caused by PCBs.

In 2006, a transformer oil spill at a facility engaged in the manufacture and repair of transformers was reported to NEPA. Citizens in the community reported damage to vegetation but no oil or soil samples were taken and analysed; although it was not established that the oil contained PCBs, circumstantial information indicated that this was the case. There was no satisfactory response from the owners of the facility to an enforcement notice issued by NEPA requiring clean-up and waste management and remediation plans. Up to 2009, remediation had not taken place and recommendations were made for deep soil sampling and analysis. Eventually, the area was covered with asphalt and now functions as a car park. This is a possible PCB- contaminated site at which soil sampling and analysis are required.

#### 2.3.8.3 POP-PBDEs – Stockpiles and Contaminated Sites

The larger stockpile of these POPs is in plastic from EEE and WEEE. The quantity of c-octaBDE stockpiled in Jamaica is estimated at 12.4 t, containing 6.7 t of POP-PBDEs. These POPs are stockpiled in appliances and electronic equipment in households and institutions. Plastic casings for CRTs contain a subset of this stockpile. The c-octaBDE in these casings is estimated at 7.7 t, of which 4.2 t are POP-PBDEs.

In the transport sector, polymers in vehicles of model years 1975-2004 that are registered for use or are for sale constitute a stockpile of 2.4.t of POP-PBDEs.

Total EEE entering the waste stream annually is taken to be 18,309 t, based on waste classification data from the NSWMA. The calculated amounts of c-octaBDE and POP-PBDEs in this waste are 2.05 t and 1.1 t respectively. The disposal methods of plastic and PUR foam in end-of-life vehicles are generally undocumented. Some ELVs are burned for the scrap metal trade, so POP-BDEs contained therein (and UPOPs) would be released into the environment; others are abandoned in gullies and remote areas. A reasonable assumption is that a significant proportion of the polymers in many ELVs is disposed of in municipal waste. The POP-PBDE content of all vehicles of model years 1975-2004 that are not in use is calculated as 6.9 t.

When articles containing these POPs are discarded in municipal waste, the POP-BDEs are

leached from the plastics into soil and water, and released into the air via fires at the dumps and landfills. All municipal disposal facilities should be regarded as POP-BDE-contaminated sites.

#### 2.3.8.4 PFOS – Stockpiles and Contaminated Sites

The foam concentrate containing PFOS that is stored by entities with firefighting capability constitutes a stockpile of this POP in excess of 0.5 t. A list of sites potentially contaminated with PFOS has been compiled. Included are the airports, fire stations and military base where practice exercises using firefighting foam have been conducted, and locations of actual class B fire events. Due to the historic use of PFOS in a wide range of consumer articles, the quantity accumulated in municipal disposal facilities is likely to be high; the quantity of PFOS in disposal sites, originating from synthetic carpets, is approximately 0.4 t. This POP is very soluble in water and is therefore continuously released into ground and surface water from contaminated sites.

### 2.3.9 SUMMARY OF FUTURE USES OF POPS – REQUIREMENTS FOR EXEMPTIONS

There are significant stocks of firefighting foam containing PFOS or that form PFOA, and it has been established the country imports short-chain chlorinated paraffins (SCCPs). Specific exemptions should be sought for the use of PFOS and PFOA in firefighting foam. Further assessment of SCCP is necessary to verify that the local applications are in line with the uses for which specific exemptions are allowed.

### 2.3.10 INFORMATION ON ENVIRONMENTAL AND BIOMONITORING OF POPS, IMPACTED POPULATIONS AND ENVIRONMENTS, THREATS TO PUBLIC HEALTH OR ENVIRONMENTAL QUALITY

Studies prior to the 2005 NIP measured and tracked levels of pesticides (including POPs) in water bodies across Jamaica and in water, sediment and shrimp in the Rio Cobre basin. Decreases in levels or non-detection correlated with cessation of use. All POPs pesticides detected throughout were found in Kingston Harbour, both water and sediment, into which the Rio Cobre drains. Much-needed direct follow-up studies have not been carried out, but there have been a number of other POP-related research and monitoring studies.

As part of the Caribbean Environmental Health Programme (CEHP), prenatal exposure to POPs was measured by analysis of blood and urine samples from 47 pregnant or delivering Jamaican women.[24] Concentrations of PCB 153, DDT, dioxin and PBDEs were found to be lower in blood than concentrations reported in Canada and the USA. In another study, lipid-adjusted concentrations of 100 PCB congeners and 17 organochlorine pesticides in umbilical cord blood serum of 67 newborns in Jamaica were determined.[25] Levels were found to be similar to or lower than those reported for (a) maternal blood in the CEHP study, and (b) cord blood serum

or maternal blood from other studies in Canada or the USA.

Jamaica participated in the GRULAC segment of the Global Monitoring Programmes (GMPs). Human breast milk data (2011) from Jamaica for GMP1 is contained in the referenced report.[26] Samples from Jamaica had PCDD/PCDF levels of 90 pg/g fat, the highest in the region; the range was 35-90 pg/g. The sum of DDTs was 150 ng/g fat (range 120-2,500 ng/g) and dieldrin was found at 2.3 ng/g fat (range 0.25-7.6 ng/g), although neither DDT nor dieldrin have been used in Jamaica for several years. Breast milk samples analyzed in 2017 for GMP2 contained chlordane, DDT, the drins (dieldrin, endrin, endrin aldehyde), endosulfan, heptachlor, hexachlorobenzene, lindane and PCBs. The GMP results encapsulate the POPs issue, particularly in regard to dioxins and furans.

Emissions from burning of garbage, burning of sugar cane fields for harvesting, and fires at waste disposal sites contain PCDD/PCDF. These open-burning processes take place near population centres, resulting in large segments of the population being exposed to these POPs.

### 2.3.11 INFORMATION, AWARENESS AND EDUCATION

The results of polls conducted in the NIP workshops indicate fair knowledge of general POPs issues among senior technical and occupational safety and health professionals in the public and private sectors. Awareness of PCBs was fairly good among employees in entities visited for the PCB survey; however, in many instances, this did not translate to appropriate practices, particularly in regard to the disposal of large quantities of obsolete fluorescent light ballasts in municipal facilities. There remains a need, as pointed out in the 2005 NIP, for better training in PCB issues at all levels.

Frequent and widespread open burning (of household and garden waste, and clearing land for agriculture) demonstrates a general lack of awareness of the hazards of this practice – whether they be particulates, greenhouse gases or UPOPs. The Jamaica Fire Brigade and RADA, separately and collaboratively, mount intermittent campaigns to dissuade open burning and promote composting of biodegradable waste. There is a need for a sustained public education campaign to raise awareness of the general population about all emissions from open burning. Also needed is an information programme targeted to both public and private sector stakeholders that operate facilities that are sources of UPOPs.

Brominated flame retardants (BFRs) and PFAS appear to be unfamiliar topics among relevant stakeholders. Results of the polls taken during the consultation workshops showed general

awareness that the products (plastics, firefighting foam) likely contain harmful chemicals. However, challenges encountered during the PFOS inventory (diffidence and pushback from some stakeholders) were interpreted as resulting from a lack of knowledge of the issue.

While no POPs pesticides are registered for use in Jamaica, the PCA and RADA deploy significant resources to education of stakeholders and the general public on hazards and safe handling of pesticides.

In school curricula, there is content on pollutants and on causes and abatement of pollution at all levels: at the primary level – grades 4-6, in social studies and science; at the secondary level for the external examinations at grade 11, in agricultural science, biology, chemistry, geography, human and social biology, integrated science; at the advanced secondary level for the external examinations at grades 12 and 13 in agricultural science, chemistry, environmental science and sociology. POPs are not mentioned in these syllabi, nor is there any POPs content in any of the tertiary-level course outlines surveyed.

### 2.3.12 REPORTING UNDER ARTICLE 15 ON MEASURES TAKEN TO IMPLEMENT THE PROVISIONS OF THE CONVENTION AND INFORMATION EXCHANGE WITH OTHER PARTIES

Pursuant to Article 15, Jamaica submitted a report in 2016 to the Convention Secretariat in the third round of Party reports. The periodicity of national reporting is every four years and in accordance with a format as established by the COP at its first meeting (decision SC-1/22) Exchange of information on POPs with other Parties takes place in regional and international fora. In 2009, Jamaica was the venue of a regional training workshop on the ESM of PCBs and POPs waste organized by the Convention Secretariat. Activities surrounding the regional project on disposal of obsolete pesticides, including POPs, described in section 2.3.1.2 entailed exchange of information on POPs pesticides. The delegation from Jamaica participates actively in the biennial meetings of the COP.

### 2.3.13 RELEVANT ACTIVITIES OF NON-GOVERNMENTAL STAKEHOLDERS

#### 2.3.13.1 Private Sector

The reduction, since the 2003 inventory, of the amounts of PCBs and items of PCB equipment that are in storage has been the result of activities in the private sector. The JPSCo maintains an ongoing PCB Management Programme aimed at the removal of equipment containing PCBs. Aspects of this programme are described in section 2.3.2. Smaller entities have partnered with the JPSCo or the bauxite-alumina companies in the export of PCBs for disposal. There is general compliance in the private sector with the non-regulatory approach to PCB elimination. Some of these entities are transnational, and this compliance may be motivated by an awareness of PCBs and corporate stewardship considerations in the parent companies.

#### 2.3.13.2 Research Institutions

The Pesticides Research Laboratory, UWI, participated in the GRULAC segments of the two Global Monitoring Programme cycles, GMP1 (2010-2014) and GMP2 (2015-2019). Activities are described in sections 2.3.10 and 2.4; also mentioned in section 2.4 are two PCB-related research projects carried out at the UWI.

#### 2.3.13.3 Civil Society

Advocacy groups focus on what are perceived to be Jamaica's more pressing environmental concerns; examples are the long-term impact of the bauxite-alumina industry and the accumulation of plastic waste in the marine environment. The introduction of POPs issues to this sector could catalyse an increase in general public awareness.

### 2.3.14 TECHNICAL INFRASTRUCTURE FOR POPS ASSESSMENT, MEASUREMENT AND ANALYSIS AND LINKAGE TO INTERNATIONAL PROGRAMMES

This is relevant to Articles 5, 6, and 11 of the Convention. The capacity to readily monitor and enforce environmental standards for limits of POPs is contingent on the availability of in-country instrumentation and technical expertise. There is local analytical capability (GC-MS, GC-ECD) for most of the POPs pesticides and for PCBs in liquid and solid samples. Two of the laboratories with this capacity are accredited by the Jamaica National Agency for Accreditation for conformity with the ISO/EC "General requirements for competence of testing and calibration laboratories". The Pesticides Research Laboratory, UWI, which participated in the GRULAC segments of GMP1 and GMP2, has the capability for air sampling of PCBs and pesticides and for analysis of speciated PCBs and low concentrations of pesticides (congener analysis, see section 2.3.10). Dioxins and furans are not analyzed; the situation is unchanged since the 2005 NIP. However, NEPA runs annual Visible Emissions Observer training workshops, open to the public and private sectors, at which participants are trained to estimate levels of visible emissions from industrial production plants.

Instrumentation for identification and quantification of POP-PBDEs (GC-MS with electron capture negative ionization) is not available locally. The determination of PFOS and PFOA requires a liquid chromatography triple quadrupole mass spectrometer. While one unit is in place, training and standards are needed for establishment of full technical capability.

### 2.3.15 TECHNICAL INFRASTRUCTURE FOR POPS MANAGEMENT AND DESTRUCTION

There are no hazardous waste landfills apart from two asbestos cells located at the Riverton Disposal Facility. Plans are in place to establish sanitary landfills at Riverton and at Retirement in

the western part of the island (section 3). When managed, hazardous waste that contains POPs (electrical equipment with PCBs, WEEE, and pesticides) is exported for destruction. The cement kilns at the Caribbean Cement Company, from reported specifications, are technically capable of destroying PCBs and pesticides but this possibility has not been explored. There is one privately owned incinerator that has been utilized by the PCA for destruction of small quantities of non-POPs pesticides. The following technologies for destruction of more recent POPs are not available locally:

| | |
|---|---|
| High-temperature incineration – HTI | (POP-PBDEs, PFOS, PFOA) |
| Plasma arc | (POP-PBDEs, PFOS, PFOA) |
| Gasification and pyrolysis | (POP-PBDEs) |
| Supercritical water (SCW) oxidation | (POP-PBDEs) |

A feasible option for firefighting foam concentrate containing PFOS is solidification with cement and disposal in a hazardous waste landfill when this becomes available.

### 2.3.16 ASSESSMENT AND LISTING OF NEW CHEMICALS

The PCA maintains a register of pesticides permitted for use in Jamaica, and applications for registration of new pesticides must be submitted to the Authority. The applications are then considered by the Pesticides Review Committee which assesses the technical information and makes recommendations to the PCA.

There is no formal register of other chemicals permitted for use in the country. However, the application process for importation of chemicals and chemical products that are administered by the SRD of the MOHW entails an assessment of the substances, and this assessment is informed by content from international databases.

### 2.3.17 ASSESSMENT AND REGULATION OF CHEMICALS ALREADY IN THE MARKET

Regulation of chemicals in commerce locally is generally driven by obligations under international agreements and entails legislative measures preceded by stakeholder consultation. Endosulfan, listed as a POP in 2011, was widely used in Jamaica to control the coffee berry borer. In the same year, it was prohibited under the Pesticides Act, 1975; coffee growers had been informed before of the impending addition of endosulfan to Annex A of the Convention and alternatives had been identified.

Compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer is the result of extensive engagement with the heating, ventilation and air conditioning sector, coupled with a raft of regulations under the Trade Act, 1955 restricting the importation of ozone-depleting substances.

## 2.4 NIP IMPLEMENTATION STATUS

When Jamaica's initial NIP was produced in 2005, the twelve initial POPs were listed to the Convention – nine pesticides, PCBs, and the two exclusively Annex C chemicals, PCDD and PCDF. Actions taken since 2005, including introduction of new legislation that advances Jamaica's compliance with the provisions of the Convention, are described in this section.

*Article 3: Measures to eliminate releases from intentional production and use*

All POPs pesticides were prohibited in Jamaica prior to 2005. Endosulfan, listed to Annex A in 2011, was prohibited in the same year by an amendment of the Pesticides Regulations.

In 2005, the total quantity of PCBs was estimated at 70.3 kg in 158,942 kg PCB-containing oil in approximately 1,300 transformers. This quantity has been reduced to approximately 18 kg as a result of the decommissioning and replacement of transformers under the aegis of the JPSCo PCB Management Programme.

*Article 4: Register of specific exemptions*

Jamaica has not registered for any specific exemptions.

*Article 5: Unintentional production*

Relevant legislation

- *Natural Resources Conservation Authority (Air Quality) Regulations, 2006*
  - All twelve initial POPs are listed in the Second Schedule of the Regulations as Priority Air Pollutants.
  - Most UPOPs source categories are included in the Fourth Schedule of the Regulations. The Schedule covers:
    - air pollutant discharge licence system;
    - reporting, and
    - incentive scheme for operators.
- *Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015*
- *Natural Resources Conservation (Environmental Protection Measures) Order, 2016* – An order prohibiting open burning.

Since 2005, there has been a move away from incineration of hospital waste and significant quantities are now autoclaved and disposed of in municipal waste.

*Article 6: Measures to reduce or eliminate releases from stockpiles and waste*

Relevant legislation

- *Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013* – Maximum allowable concentrations in solid waste/industrial sludge suitable for landfill, are prescribed for a number of POPs – DDT, endrin, heptachlor, and lindane (listed as a POP in 2009)

The *National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper)* outlines an implementation roadmap which will focus on priority hazardous wastes within the short to medium term which includes POPs.

Several shipments of PCB-containing oil and equipment contaminated with PCBs, totalling more than 400 t have been exported for destruction (section 2.3.2). Shipments of obsolete pesticides totalling 5.1 t including POPs pesticides have been exported for disposal (section 2.3.1.2).

*Article 7: Implementation plans*

An initial NIP was completed in 2005 and transmitted to the COP in 2011. This is the updated NIP.

*Article 8: Listing of Chemicals in Annex A, B and C*

Jamaica has supported the proposals to the Secretariat that have resulted in the listing of additional chemicals to Annexes A, B and C since 2009. Supporting activities include:

(a) extensive consultation with local stakeholders prior to the addition of endosulfan to Annex A in 2011 and
(b) membership on the POPs Review Committee (POPRC) of the Stockholm Convention by a representative from Jamaica for the term 2016-2019.

*Article 9: Information exchange*

The process of information exchange with other Parties, directly or through the Convention Secretariat, should begin with the adoption of the measures recommended in the updated NIP.

*Article 10: Public information, awareness and education*

As part of their mandates, several agencies promote chemical safety and environmental

awareness. Although POPs may not always be specified in the programmes and campaigns, they are, by definition, included. Examples follow:

- The Pesticides Control Authority deploys significant resources to public education on hazards and safe use of pesticides.
- The Rural Agricultural Development Authority (RADA) advocates safe and reduced use of pesticides via:
  - farmer and stakeholder capacity building for correct use of pesticides and monitoring and surveillance of pesticide use practices;
  - promoting practices of integrated pest management aimed at reducing reliance on pesticides.
- NEPA's public education, training and outreach activities in the area of chemical safety and management are carried out by the Environmental Management sub-division. Some activities are:
  - island-wide workshops aimed at increasing public awareness about the proper use and handling of chemicals, held in collaboration with other groups and agencies, including CARPIN and the MOHW;
  - campaigns to raise awareness on environmental issues in selected communities – for example, the 2012 PAHO-sponsored Anti-Pollution thrust that entailed a risk assessment of communities in the Greenwich Farm area, which led to the development of a number of public advertisements which are still being used in awareness campaigns;
  - pollution Incidents workshops held in concert with the JCF and JDF, held annually since 2011, with a focus on how to deal with pollution incidents and sample collection.
  - training to special groups and employees of companies in the private sector.
  - In 2009-2011, Jamaica participated as a pilot country in the UNITAR/ILO Global GHS Capacity Building Programme through a National GHS Capacity Building Project, coordinated by the Environmental and Risk Management Division. Through this project, several individuals in academia, government, the private sector and civil society who work in and influence developments in the agriculture, consumer products and transport sectors and in industrial workplaces became conversant with the GHS conventions for labelling and communication of chemical hazard information. Project activities included awareness-raising workshops.

*Article 11: Research, development and monitoring*

Prior to the 2005 NIP, there were a number of scientific studies had been completed on the extent of pesticide contamination (including POPs) in the Jamaican environment. These are

summarized in the previous NIP and the publications cited. Since 2005, the two POPs-related research projects listed below have been undertaken at the UWI.

- Dechlorination of polychlorobiphenyls by Pd-, Pt- and Ni-HY zeolite in alkaline 2-propanol.[27]
- Bioaccumulation of polychlorinated biphenyls (PCBs) in Atlantic sea bream (*Archosargus rhomboidalis)* from Kingston Harbour, Jamaica.[28]

*Article 12: Technical assistance*

Jamaica is a recipient of technical assistance. In 2009, Jamaica was the venue of a regional workshop on the Environmentally Sound Management (ESM) of PCBs and POPs waste organized by the Secretariat of the Stockholm Convention in compliance with decisions SC-3/7 and SC-4/8 of the COP.

*Article 13: Financial resources and mechanisms*

The process of review and update of the initial NIP is supported by a grant from the Global Environment Facility (GEF). In 2010, subsequent to the completion of the 2005 NIP, Jamaica participated in a regional GEF-funded project *Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean;* details are in section 2.3.1.2.

*Article 15: Reporting*

Jamaica submitted a national report on measures taken for implementation of the Convention during the third round of Party reports. The periodicity of national reporting is every four years and in accordance with a format as established by the COP at its first meeting (decision SC-1/22).

*Article 16: Evaluation*

The main mechanism of this evaluation is the Global Monitoring Programme (GMP). Jamaica, through the Pesticides Research Laboratory, UWI, participated in the GRULAC segments of the two GMP cycles, GMP1 (2010-2014) and GMP2 (2015-2019); both programmes entailed determination of levels of POPs in the environment and in human blood and breast milk. Participation was enabled by technical and financial support from UNEP.

# 3

# STRATEGY AND ACTION PLAN ELEMENTS OF THE NIP

## 3.1 POLICY

The updated POPs management policy derives from the policy articulated in the 2005 NIP with changes consequent on

- Implementation of some of the measures recommended in the NIP
- The listing to the Convention of several industrial chemicals, 2009-present
- Developments in the national policy framework

As stated in the previous NIP, the policy "…reflects the recognition of the risks posed by POPs chemicals and is based on core principles. The policy will rely on integration with, and where necessary expansion of, existing related environmental policies and Jamaica's sustainable development strategy."

### 3.1.1 PRINCIPLES THAT UNDERPIN THE POLICY

As in the previous NIP, the three principles listed below will guide the implementation of the POPs management policy.

The Precautionary Principle – Precautionary measures are taken in relation to potential dangerous releases to the environment even when scientific information about harmful effects is limited and does not allow the risks to be determined with certainty.

The Polluter Pays Principle – Potential polluters must exercise due diligence in prevention of releases of pollutants to the environment and in assessment, clean-up and remediation of contaminated sites.

The Community Right to Know Principle – Individuals have the right to know the environmental hazards to which they are exposed.

### 3.1.2 ELEMENTS OF THE POLICY

a. Minimize the exposure of the Jamaican population to incidentally formed POPs through a mix of incentives[1] and penalties to facilitate behaviour
b. Prohibit the importation of all POPs
c. With respect to PCBs – adhere to the conditions and timetable prescribed in Annex A, Part I of the Stockholm Convention
d. Eliminate stocks of articles and products containing POPs (other than PCBs) in accordance with the timelines given in the Convention

[1] For example, consideration could be given for the provision of duty waivers/concessions on environmentally friendly inputs for the productive sector for a specified period

e. Manage wastes containing POPs in an environmentally sound manner, with particular attention to reducing exposure of children, women, and vulnerable populations to POPs-containing waste
f. Minimize the exposure of the Jamaican population to POPs released into various environmental compartments (air, water, soil/sediment)
g. Promote awareness of POPs issues among stakeholders and the general population through appropriate public education programmes and introduction of relevant subject material in training curricula
h. Endeavour to meet all Jamaica's obligations under the Stockholm Convention

## 3.2 IMPLEMENTATION STRATEGY

The strategy for implementing the POPs management policy entails, *inter alia*:

a. Appropriate institutional arrangements
   - Designation of a specific ministry, department or agency as the coordinating body for POPs management activities
   - Clear definition of the roles and responsibilities of agencies and institutions in the NIP implementation process

b. Deploying the necessary physical and human resources, building capacity of institutions, and stakeholder engagement
c. Integrating POPs management with national policies on the management of waste, with the National Policy on Gender Equality (NPGE) and with implementation of other chemicals conventions and international agreements.

### 3.2.1 INSTITUTIONAL ARRANGEMENTS

The coordinating role for NIP execution should reside in the Ministry with portfolio \ responsibility for the environment (currently the MEGJC), designated as the "technical focal point" of the Stockholm Convention. Management of POPs, however, requires close coordination between multiple ministries, departments and agencies (MDAs). Critical MDAs and their roles include but are not limited to:

- Jamaica Customs Agency (JCA, regulating imports and exports, transiting), Ministry of Health and Wellness, Standards and Regulation Division (MOHW-SRD, regulating importation)
- National Environment and Planning Agency (NEPA, permitting and monitoring), the Rural Agricultural Development Authority (RADA), Forestry Department (monitoring burning of vegetation that releases UPOPs to the environment)

- National Solid Waste Management Authority (NSWMA, management of solid waste containing POPs)
- Pesticides Control Authority (PCA, pesticides management)
- National Water Commission (NWC), Water Resources Authority (WRA), National Environment and Planning Agency (NEPA) (setting standards for POPs in drinking water, monitoring POPs in sewage)
- Attorney General's Chambers (AGC, guidance on development of proposed legislation), Office of the Parliamentary Council (OPC, drafting legislation)

A suitable mechanism should be used to formalize the collaboration between the MDAs for NIP implementation. Through this mechanism, the roles and responsibilities of each agency should be clearly defined and specific activities assigned.

Implementation of the NIP and active management of POPs will require enforcement of applicable legislation as well as amendment of existing instruments and, ultimately, development of new legislation. The mandate and activities of the coordinating body for NIP implementation should be congruent with existing and proposed measures to strengthen the enforcement mechanisms of applicable legislation.

For information sharing among public sector agencies and with stakeholders in other sectors, consideration should be given to the establishment of a "Stockholm Convention" or "POPs Management" section on the website of the relevant ministry. In addition to basic facts about the Convention and POPs, all information on local POPs management efforts could be consolidated here. This measure, appropriately presented and managed, has the potential to stimulate interest and progress in implementation of the action plans.

### 3.2.2 PHYSICAL AND HUMAN RESOURCES, STAKEHOLDER ENGAGEMENT

#### 3.2.2.1 Physical Resources

There has been little change in the limited physical resources for POPs management (storage sites, disposal facilities, capacity for sampling and analysis) described in the 2005 NIP. The subsequent addition to the Convention of several industrial chemicals, some embodied in a wide range of articles and products, has further increased the need for suitable infrastructure.

- There are plans for upgrading the national infrastructure for disposal of hazardous waste (section 3.3.8); operationalization will facilitate safe disposal of POPs-containing domestic and industrial wastes, including fluorescent light ballasts.

- The quantities of POPs and POPs-containing waste to be destroyed are not sufficient to merit establishment of a local high-temperature incineration facility. It is envisaged that the current arrangements of export of these wastes for destruction will continue.
- Sampling and analytical capability for all POPs depend on the acquisition of instrumentation and standards.

#### 3.2.2.2 Human Resources

The public sector human resource requirement for execution of the NIP is estimated to be approximately ten full-time equivalents (FTEs) across all participating MDAs; for comparison, the estimate for the 2005 NIP was ca. seven FTEs. A breakdown of the current requirement is shown below:

| | | |
|---|---|---|
| MEGJC, NEPA, NSWMA | 0.5-1.5 FTE each | totalling 6 |
| AGC, FD, JCA, JFB, MOHW, MSET, NCRA, NWC, OPC, PCA, RADA, STATIN, WRA | partial FTEs | totalling 4 |

Without detailed analyses of the job functions of the current HR complement, it is not possible to determine the quantum of this resource requirement that is in already place, and if additional personnel will be required. Indications are, however, that chemicals management in government is under-resourced, and this may be part of the reason for the implementation deficit of the previous NIP. The HR costs for MDAs are not specified in Tables 3.1-3.12 detailing the action plans, but the costing of the estimated ten FTEs is provided in Table 3.13 and included in the total cost of executing the NIP.

### 3.2.3 TRAINING, STAKEHOLDER ENGAGEMENT AND PUBLIC EDUCATION

Awareness of POPs issues is very limited, even in tertiary-level institutions (TLIs) and among users of POPs-containing articles and products. A multi-pronged approach to promoting stakeholder participation is necessary.

- A teaching module on the chemicals that fall under the purview of the MEAs to which Jamaica is a Party (with emphasis on POPs) should be prepared for the curricula of TLIs, inclusive of teacher training colleges. Appropriate content should be added to the curricula of primary and secondary schools.
- Outreach activities (seminars, workshops, short courses) targeted to the groups listed below and others will be required for effective stakeholder participation.
  - public and private sector entities that:

- use POPs-containing articles and products
- generate UPOPs

➢ relevant professional organizations (Jamaica Institute of Environmental Professionals, Jamaica Occupational Health & Safety Professionals Organization, Jamaica Association of Petroleum Marketers)

➢ policy and decision-makers in the public and private sectors, including educators from tertiary-level institutions (TLIs)

➢ entities that will be directly involved in operationalizing the NIP – for example, the Waste Management Authorities

- Public education for POPs management, as stated in the 2005 NIP, must entail a campaign that:
  - ➢ builds awareness of the human health and ecological risks from exposure to POPs, especially those industrial chemicals embodied in consumer articles
  - ➢ enables the public to recognise and identify potentially dangerous pesticides, PCB ballasts and other hazardous materials
  - ➢ provides information on alternatives to burning (trash, garbage, clearing land or agriculture)
  - ➢ provides information and means to dispose of unwanted pesticides, PCB ballasts and other hazardous materials

The resources available through the Basel, Rotterdam and Stockholm (BRS) Secretariat should, as much as possible, be utilized in efforts to accomplish the foregoing.

### 3.2.3 INTEGRATING POPS MANAGEMENT WITH NATIONAL POLICIES ON THE MANAGEMENT OF WASTE AND IMPLEMENTATION OF OTHER MULTILATERAL ENVIRONMENTAL AGREEMENTS (MEAS)

Many aspects of the updated NIP fall within the framework of the soon-to-be-adopted National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper). Sections of this policy specifically address POPs-containing waste and are directly relevant to implementation of the Stockholm Convention.

- POPs chemicals are listed among the categories of hazardous waste identified for priority attention in the short to medium term.
- Development of a management plan for speedy elimination of PCB-containing electrical equipment in the transmission and distribution systems and updating of the PCB Management Guideline are proposed as short/medium-term policy implementation actions.

The policy outlines an implementation roadmap which will focus on priority hazardous wastes within the short to medium term, and which includes POPs. The aims and objectives of the NIP, particularly those targeted to the reduction of POPs emissions by improved management of waste, are entirely consistent with a significant subset of those articulated in this policy.

The synergies between the Basel, Rotterdam and Stockholm Conventions should, as far as possible, be leveraged towards achieving the objectives of this updated NIP. Jamaica also is party to the Minamata Convention on Mercury and the Paris Agreement on Climate Change. Meeting the obligations of these instruments entails monitoring and reduction of emissions from sources (open burning, waste incineration, industrial activities) that produce unintentional POPs (UPOPs), mercury, and greenhouse gases. Compilation of databases of sources and development of analytical capability can, with minimal coordination, be achieved by an integrated approach. A common approach to waste management improvements (Best Available Technology/Best Environmental Practices (BAT/BEP) measures) and public education on the hazards of open burning will be an efficient way of meeting key requirements of all three agreements.

## 3.3 ACTION PLANS, INCLUDING RESPECTIVE ACTIVITIES AND STRATEGIES

### 3.3.1 ACTIVITY: INSTITUTIONAL AND REGULATORY STRENGTHENING MEASURES

The action plan shown in Table 3.1 incorporates the proposed institutional arrangements described in section 3.2.1. It also includes general proposals for a number of legislative amendments; some rationales and elaborations are provided below.

Although the legal framework is in place for meeting Articles 3, 5, and 6, the legislative measures are, in many cases, not implemented and enforced – particularly for management of waste and generation of UPOPs by open burning and vehicle emissions. Three pieces of legislation with the potential to control UPOPs, but are ineffective for the reasons given are:

- The Country Fires Act, 1942 – outdated with low penalties (the low penalties are being addressed by the Legal Reform Department of the Ministry of Justice)
- The Forest Act, 1996 – limited institutional capacity to enforce the regulations

Omnibus legislation that addresses open burning is therefore proposed.

The legislation in draft – The Hazardous Chemicals and Pesticides Management Act (2017 draft) – is intended to incorporate Jamaica's obligations under the Stockholm Convention (as well as

the Rotterdam, Minamata, and Chemical Weapons Conventions, aspects of the Basel Convention, and the Globally Harmonized System of Classification and Labelling of Chemicals). The enactment of this legislation does not appear to be imminent; it may be some time before it comes into effect. In the interim, introduction of relatively straightforward regulations under existing laws, and relevant labelling standards, can serve to advance Jamaica's compliance with the Convention with respect to the more recently listed POPs. Promulgation of any new regulations and standards would have to be preceded by extensive engagement with stakeholders to identify and adopt alternatives to substances that may be in use so that stakeholders will not be in breach of the amended legislation.

The regulations under the Trade (Montreal Protocol) (Trade in Ozone Depleting Controlled Substances) Order, 2014 of the Trade Act, 1955 restricting the importation of ozone-depleting substances, and elements of the stakeholder engagement process that have resulted in Jamaica meeting its obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer indicate a possible course of action towards regulation of the recent POPs that are industrial chemicals. Alternatively, consideration could be given to amending Table II in the First Schedule of the Precursor Chemicals Act, 1999 as a way of regulating industrial chemicals that are POPs. Of note, however, is that these POPs are often embodied in consumer articles, as opposed to being components of formulations, and in these matrices may not meet the definition of "specified chemical substance" in the Act.

**Table 3.1: Institutional and regulatory strengthening measures**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Formalize a coordinating mechanism for POPs management in the public sector | Create an interagency POPs management committee or repurpose an existing interagency committee, mandated, *inter alia*, to:<br>(i) coordinate implementation of the recommendations of this NIP;<br>(ii) engage stakeholders from all sectors; (iii) monitor the listing and management of POPs added to the Convention in the future | Committee established and operational;<br>MOU in place, if necessary | 1 year | MEGJC, MFAFT<br>NEPA<br>AGC | Administrative and technical HR | |
| Harmonize the roles of the institutions that influence the formation of UPOPs | Develop a policy document that clearly defines roles of the various stakeholder Ministries and Agencies. Institutional and Regulatory Strengthening Measures | Roles of stakeholder agencies clearly defined | 1.5 years | MEGJC<br>MOAF, MLGRD, NEPA, RADA, Forestry Department, JFB | HR: Task Force or Steering Committee<br>Financial: Consultancy services | Consultancy services<br>25,000 |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Legislate:<br>(a) the prohibition of POPs not currently prohibited;<br>(b) levels of POPs in wastewater, sludge, drinking water | *Short term*<br>Draft and enact regulations to prohibit the production, import and export of Annex A and B POPs not currently prohibited | Regulations promulgated | 2 years | MEGJC, PCA, NEPA, *AGC, OPC* | Legal HR | |
| | *Short term*<br>Amend the Wastewater and Sludge Regulations and drinking water standards to include:<br>(i) standards/limits for POPs in ambient water (2005 NIP); (ii) limits for PCBs, dioxins, furans HCB in sewage sludge (2005 NIP); (iii) limits for PFAS in drinking water. | Regulations promulgated | 3 years | MEGJC, PCA, NEPA, AGC, OPC | Legal HR | |
| | *Medium-term*<br>Complete the drafting of the Omnibus Chemicals Legislation and promulgate the Act | Legislation enacted | 3 years | MEGJC, MOHW, PCA, NEPA, AGC, OPC | Legal HR | |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Harmonize and strengthen the legislation that impacts on generation of UPOPs | • Rationalise/harmonise the multiple legal instruments that address open burning and assign institutional roles aligned with expertise.<br>• Agricultural land clearing, accidental fires, and arson all cause releases of UPOPs but need to be managed differently to minimise releases<br>• Institute effective incentives and penalties to prevent/discourage open burning<br>• Strengthen the enforcement capabilities to reduce the number of plastics in municipal solid waste | Omnibus Legislation governing open burning enacted | 3 - 6 years | MEGJC, MOAF, MLGRD, OPC, NEPA, RADA, Forestry Department, JFB, NGOs | Human resources: Task Force or Steering Committee<br><br>Financial: Consultancy services | Consultancy services<br>45,000* |
| Legislate the separation of POPs waste from municipal waste | Revise the National Solid Waste Management Authority (Public Cleanliness) Regulations, 2003 or create a new instrument to mandate that items containing PCBs, BFRs and other POPs be removed from the regular municipal waste | Promulgated regulations aligned with Stockholm Convention requirements | 3 years | NSWMA<br>AGC, OPC<br>MEGJC | | Consultancy services<br>45,000* |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Ensure that legislation in draft is consistent with the provisions of the Stockholm Convention with respect to brominated flame retardants | Review/revise the National Solid Waste Management (Disposal of Hazardous Waste) (Electronic and Electrical) Regulations (2017) draft to ensure compliance with the Stockholm Convention requirements and take into consideration that the exemption to recycle pentabromodiphenyl ether and octabromodiphenyl ether expires in 2030 | E-Waste Regulations consistent with Stockholm Convention | 2 years | NSWMA<br>AGC | HR | Consultancy services<br>45,000* |
| Ensure that import policies for articles containing POP BFRs are consistent with Stockholm Convention provisions for these chemicals | Carry out Regulatory Impact Assessment for a ban on articles containing POPs BFRs (c-penta-bromodiphenyl ether, c-octaBDE c-decaBDE, hexabromobiphenyl & hexabromocyclododecane). | Import Policy compliant with SC for BFRs.<br>Knowledge of how trade will be affected once the SC exemption expires in 2030 and POPs BFRs are completely banned | 2 years | MEGJC<br>Trade Board | Financial: Consultancy services | Consultancy services<br>45,000* |
| Strengthen border control (operationally) for import of POPs and other hazardous chemicals | Identify appropriate courses and train personnel from the JCA and NCRA | Courses identified<br>Personnel trained | 2 years | MEGJC<br>JCA<br>NCRA<br>MOHW | Training | 20,000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Strengthen the management of POPs in the agricultural sector | Conduct assessments, on an ongoing basis, to identify the challenges that affect the agricultural sector's capacity to properly manage POPs | Implement initiatives from assessment<br>Personnel trained | 2 years | MOAF | Human resources: | |

**These are the same*

### 3.3.2 ACTIVITY: MEASURES TO REDUCE OR ELIMINATE RELEASES FROM INTENTIONAL PRODUCTION AND USE

This activity is cross-cutting and applies to all Annex A and B POPs imported (as Jamaica does not manufacture these chemicals). Action plans are provided in subsequent sections for *all but three* of the subset of the 28 Annex A and B POPs that are likely imported into the island. These three chemicals, discussed in this section, are hexachlorobutadiene (HCBD), polychlorinated naphthalenes (PCN) and short-chain chlorinated paraffins (SCCP). Measures proposed for management of these POPs are shown in Table 3.2.

Hexachlorobutadiene (HCBD), which is also an Annex C POP, has not been intentionally produced since the 1970s. It is formed as a by-product in the manufacture of other chlorinated hydrocarbons and has been used in a number of applications: solvent for rubber and other polymers; gas scrubber; hydraulic, heat transfer, transformer fluid; in gyroscopes; insecticide in vineyards and fumigant for treating grapes. Of these, the only possible application in Jamaica is in transformer fluid. Oil from older transformers found to contain < 50 ppm PCB should therefore be analysed for HCBD.

Global production of PCNs ceased in the 1970s. They may co-occur with PCBs in some dielectric fluids, so their management would be consequent on that of PCB-containing articles. PCNs are also UPOPs (Annex C) and in the Jamaican context would be generated as by-products of waste incineration.

With regard to SCCPs, import data reveals that significant quantities of the chemicals that comprise this group (HS codes 2712200000, 2712900000, 3824900000) have been brought into the country from China, the Dominican Republic, Germany, Panama, Spain, Trinidad and Tobago, the United Kingdom, and the United States of America. The main applications of SCCPs are plasticisers and flame retardants. Local uses are undetermined but are probably among the acceptable uses to which specific exemptions apply: waterproofing and fire retardant paints; adhesives and sealants; lubricant additives; metal working lubricant and coolant; PVC additive. A detailed assessment of the local applications of SCCP is required so that the necessary specific exemptions can be sought and a timetable set for phase-out and replacement. Application as a waterproofing agent in textiles is not an acceptable use, and SCCPs are likely to be present in many textile articles and products in use – so products in use exemptions should also be sought.

**Table 3.2: Measures to reduce or eliminate releases from intentional production and use (HCBD and SCCP)**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs (Cost US$) |
|---|---|---|---|---|---|
| Reduce/ eliminate releases from the use of HCBD and SCCP | Determine if HCBD is present in oil from older transformers<br>Collect and analyse oil samples<br>Decide if disposal of oil is necessary and proceed accordingly | Samples analysed<br>Decisions taken | 2 years | MEGJC, Pesticides Research Laboratory, UWI | Consultancy & analytical services (12,000, 3,000) |
| | Determine the specific local applications of SCCPs<br>Engage users<br>Identify alternatives<br>Set timetable for phase-out | Applications identified<br>Need for specific exemptions assessed<br>Alternatives identified<br>Timetable for phase-out agreed | 2 years | MEGJC, industry stakeholders | HR |

### 3.3.3 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES, AND WASTES OF ANNEX A POPS PESTICIDES (ANNEX A, PART I CHEMICALS)

No POPs pesticides are manufactured locally, and all but four of the 18 POPs with pesticidal applications are prohibited or restricted in Jamaica. None of the four POPs pesticides that are not prohibited or restricted are registered for use. Relatively minor legislative amendments are therefore needed for Jamaica to become ostensibly compliant with the Stockholm Convention with respect to pesticides. (Table 3.3).

Import statistics reveal recent entry of quantities of lindane and pentachlorophenol; this indicates the need for improvements in (a) coordination between the PCA, the MOHW Standards and Regulation Division, and the Jamaica Customs Agency, and (b) awareness of POPs and technical capability of the Jamaica Customs Agency for importation of chemicals.

Subsequent to the banning of endosulfan in 2011, all identified sites contaminated with POPs pesticides were cleared and the wastes and stockpiles of POPs pesticides exported for disposal in 2017.

In the 2005 NIP, a recommendation was made to amend the Pesticides Regulations to include, *inter alia*: specifications for storage of pesticides and pesticide waste; requirements of reporting transfers of obsolete pesticides and wastes. While the strengthening of the Regulations is certainly desirable, these measures do not relate directly to POPs, so could be included in the broader framework of the *National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper)*.

DDT is not produced, imported or used in Jamaica, so there is no need for an action plan for management of this pesticide.

**Table 3.3: Measures to make Jamaica compliant with the Stockholm Convention with respect to Annex A POPs pesticides**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs |
|---|---|---|---|---|---|
| Make Jamaica compliant with the Convention with respect to pesticides | (i) Transfer dicofol from the Third Schedule to the Second Schedule of the Pesticides Act<br>(ii) Amend the listing of pentachlorophenol in the Second Schedule to include salts and esters<br>(iii) List alpha-hexachlorocyclohexane, beta-hexachlorocyclohexane, pentachlorobenzene, and perfluorooctane sulfonic acid and derivatives in the Second Schedule | Amended legislation | 2 years | PCA, AGC, MOHW, MEGJC | Legal HR |
| | Remove aldrin, dieldrin, endrin and endosulfan, from Part II of the Second Schedule of the Pharmacy Regulations, 1975 (this listing authorizes sale of these chemicals) | Amended legislation | 2 years | PCA, AGC, CPC, MOHW, MEGJC | HR |
| Stop the erroneous/ inadvertent importation of POPs pesticides and industrial chemicals | Conduct a forensic audit of importation of all POPs, 2010-present. | Audit completed<br>weaknesses identified; procedures amended | 1 year | JCA, PCA, MOHW | HR |
| | Ensure that all POPs are highlighted on the current Tariff sheet | Tariff sheet amended | 1 year | JCA, PCA, MOHW | HR |

### 3.3.4 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, IDENTIFICATION, LABELLING, REMOVAL, STORAGE, AND DISPOSAL OF PCBS AND EQUIPMENT CONTAINING PCBS (ANNEX A, PART II CHEMICALS)

This action plan (Table 3.4) is targeted towards meeting the 2025 Convention timeline for removal from service of PCB equipment and the 2028 PCB waste disposal deadline. Execution of the plan will require close collaboration with the Jamaica Public Service Company (JPSCo, the main electric utility company, which owns most of the electrical equipment in the transmission and distribution systems) within the ambit of the company's PCB Management Programme.

**Table 3.4: Identification, labelling, removal, storage, and disposal of PCBs and equipment containing PCBs**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Finalize the detailed inventory of PCBs and PCB-containing equipment | Locate and identify PCB-containing equipment based on information from JPSCo and equipment specifications (for in-service equipment) | All PCB-containing equipment located and identified<br>Inventory finalized | 1.5 years | NEPA, JPSCo<br>MEGJC, Industry stakeholders | HR | |
| | Evaluate risks and clean-up options for putative PCB-contaminated sites | Sites located and contamination or lack thereof confirmed | 1.5 years | | HR | |
| | Analyze oil and soil samples as necessary | Samples collected and analyzed | 1.5 year | Pesticides Research Lab, UWI or Bureau of Standards | Analytical services | 6,000 |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Collection and management of PCB-containing equipment for disposal, and ultimate disposal | Incorporate relevant aspects of the following guidelines into the existing Permits and Licencing Regulations to ensure compliance with the Stockholm Convention: (a) National Polychlorinated Biphenyls Management Guideline (2000); (b) NRCA Guidelines for the Secondary Containment of Hazardous Liquids Stored Above Ground (2011) | Regulations directly relevant to the use, storage and disposal of PCBs | 1.5 years | NEPA, NSWMA, OPC | | |
| | Collect, package, and securely store PCB-containing equipment (industry stakeholders) | Equipment collected, packaged, and stored at a secure site | 3 years | NEPA, JPSCo MEGJC, Industry stakeholders | HR | Borne by Industry stakeholders |
| | Carry out formal audits as per the NRCA Guidelines for the Secondary Containment of Hazardous Liquids Stored above Ground (2011) and National Polychlorinated Biphenyls Management Guideline (2000) | Permit audit reports and other related activities | 2 years | NEPA | HR | |
| | Evaluate disposal options and select appropriate method | Method for disposal selected | 3 years | NEPA, JPSCo MEGJC Industry stakeholders | HR | Borne by Industry stakeholders |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| | Disposal of PCBs and PCB-containing equipment with documentation detailing the composition of material destroyed or exported | Disposal process complete (including permit for activity if necessary); records adequate for inventory & reporting purposes | 3 years | NEPA<br>JPSCo<br>MEGJC | HR | Borne by Industry stakeholders |

### 3.3.5 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES AND WASTES OF HEXABDE AND HEPTA BDE (ANNEX A PART IV CHEMICALS) AND TETRABDE AND PENTABDE (ANNEX A PART V CHEMICALS)

From the inventory, large quantities of these POPs are present in stockpiled EEE which is steadily entering the waste stream. In the transport sector, most of the vehicles with PUR foam containing POP-BDEs (model years 1975-2004) are no longer in use and their mode of disposal is largely undocumented. Key elements of the action plan for POP-BDEs in both the EEE and transport sectors are the monitoring of the remaining articles in use that contain these POPs as they enter the waste stream and management of the waste (Table 3.10). For EEE, there is an intersection with enforcement of the proposed e-waste regulations, The National Solid Waste Management (Disposal of Hazardous Waste) (Electronic and Electrical) Regulations (2017 draft) when they are promulgated. The measures relating to policy and legislation are shown in Table 3.5 (repeated from Table 3.1).

**Table 3.5: Measures to eliminate import and export, use, stockpiles, and wastes of hexaBDE and heptaBDE (Annex A Part IV Chemicals) and tetraBDE and pentaBDE (Annex A Part V Chemicals)**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs |
|---|---|---|---|---|---|
| Ensure that legislation in the draft is consistent with the provisions of the Stockholm Convention<br>(repeated from Table 3.1) | Review/revise the *National Solid Waste Management (Disposal of Hazardous Waste) (Electronic and Electrical) Regulations (2017) draft* to ensure compliance with the Stockholm Convention requirements and take into consideration that the exemption to recycle pentabromodiphenyl ether and octabromodiphenyl ether expires in 2030 | E-Waste Regulations consistent with Stockholm Convention | 2 years | MEGJC,<br>NSWMA,<br>AGC, OPC | HR |
| Ensure that import policies for articles containing POP BFRs are consistent with Stockholm Convention provisions for these chemicals<br>(repeated from Table 3.1) | Carry out Regulatory Impact Assessment for a ban on articles containing POPs BFRs (c-penta-bromodiphenyl ether, c-octaBDE c-decaBDE, hexabromobiphenyl & hexabromocyclododecane). | Import Policy compliant with SC for BFRs.<br>Knowledge of how trade will be affected once the SC exemption expires in 2030 and POPs BFRs completely banned | 2 years | MEGJC<br>Trade Board | Financial: Consultancy services |

| | | | | | |
|---|---|---|---|---|---|
| Legislate the separation of POPs waste from municipal waste<br>(repeated from Table 3.1) | Revise the NSWMA (Public Cleanliness) Regulations, 2003 or create a new instrument to mandate that items containing PCBs, BFRs and other POPs be removed from the regular trash | Regulations promulgated that are aligned with Stockholm Convention requirements | 3 years | NSWMA<br>AGC<br>MEGJC | |
| Legislate the prohibition of POPs not currently prohibited (repeated from Table 3.1) | Implement import restrictions for articles containing c-pentabromodiphenyl ether<br>c-octabromodiphenyl ether, decabromodiphenyl ether and hexabromocyclododecane.<br>Coordinate with revision of motor vehicle import policy. | Cessation of importation of BFR containing articles manufactured from recycled polymers. | 2 years | MEGJC<br>Trade Board<br>AGC, OPC | |

### 3.3.6 ACTIVITY: PRODUCTION, IMPORT AND EXPORT, USE, STOCKPILES, AND WASTES OF PFOS, ITS SALTS AND PFOSF (ANNEX B, PART III CHEMICALS) AND OF PFOA

All PFOS and PFOA in Jamaica are imported in articles and products. The inventory of firefighting foam concentrate conducted for this NIP revealed that a significant proportion of these products contain PFOS and PFOA. These substances are not currently subject to local regulatory control, so this inventory was based on voluntary disclosure and was only partial. Several sites that are likely contaminated due to firefighting training exercises and actual fire events were identified, and stakeholder awareness of the issues and hazards associated with the use of articles and products containing PFOS and PFOA is generally low. Execution of the proposed action plan (Table 3.6) for compliance with Convention requirements with respect to PFOS and PFOA will result in reduced exposure of the population to these chemicals.

**Table 3.6: Measures to eliminate import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF (Annex B, Part III chemicals) and of PFOA**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs |
|---|---|---|---|---|---|
| Develop the regulatory framework for PFAS (Table 3.1) | Prohibit the import of articles and products containing PFOS and PFOA | Promulgated regulations, possibly under the Trade Act | 2 years | MEGJC,<br>AGC, OPC, MIIC, JCA | Legal HR |
| | Set limits for levels in drinking water and in in solid waste/ industrial sludge suitable for landfill | Promulgated regulations | 4 years | MOHW- EHU, NSWMA, AGC, OPC<br>NEPA, WRA | Legal HR |
| Awareness raising and training of stakeholders<br>(Table 3.12) | Engage key stakeholders, including but not limited to those from the following sectors<br>• Firefighting<br>• Petroleum refining and marketing<br>• Importers<br>• Professional organizations and TLIs (JIEP, JOHSPA, UWI, UTECH) | Workshops, seminars, training programs complete; subject matter incorporated into curricula of OSH training programs | Within 1 year, then continuously until 2025 | MEGJC, NEPA, JFB | Administrative and technical HR |
| Environmentally sound management of stockpiles | Implement the guidance on BAT/BEP for the use of PFOS/ PFOA for exempted uses | Environmentally sound procedures in place | 1 year | MEGJC, NEPA<br>JFB, other users or firefighting foam | Administrative and technical HR |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs |
|---|---|---|---|---|---|
| Obtain more accurate information on stockpiles | Refine the preliminary inventories of firefighting foam and other articles and products containing PFOS/PFOA | Database of PFAS-containing firefighting foam and consumer articles | 1 year | MEGJC, NEPA, MOHW-SRD | Administrative and technical HR |
| Disposal of PFAS-containing products | In collaboration with industry stakeholders, develop a program of consolidation of PFOS/PFOA containing firefighting foam concentrate for disposal; this can be virtual, as the material can remain stored in situ. | Foam concentrate for disposal identified; disposal options identified | 2 years | MEGJC<br>NEPA<br>Industry stakeholders | Administrative and technical HR |
| Obtain more accurate information on contaminated sites to determine the need for remediation<br>(Table 3.11) | Refine the inventory of sites contaminated with PFOS/PFOA from training activities and actual fire events | Database of contaminated sites | 2 years | MEGJC, JFB<br>NEPA, Mona Geoinformatics Institute | Administrative and technical HR, finance (costs in Table 3.11) |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs |
|---|---|---|---|---|---|
| Develop technical capability for analysis and monitoring of PFAS in the environment (Table 3.11) | Establish sampling and analytical capability for PFAS | Instrumentation acquired and installed; operators trained | 3 years | MEGJC, UWI, ICENS | Finance (costs in Table 3.11) |
| Determination of the need for remediation (Table 3.11) | Monitor the levels of PFAS in environmental media, focusing on the putative-contaminated sites | Monitoring program in place; data on PFAS levels; remediation needs identified | 5 year | MEGJC, NEPA, JFB, industry stakeholders | Finance (costs in Table 3.11) technical HR |

### 3.3.7 ACTIVITY: REGISTER FOR SPECIFIC EXEMPTIONS

Parties to the SC may, under Article 4, produce and or use listed POPs for purposes specified in the Convention, generally for periods of up to five years after entry into force of the SC with respect to a given chemical. Parties must register for these *specific exemptions,* and the SC maintains a list of these – *Register of Specific Exemptions*.

Jamaica should, as soon as possible, register for the following specific exemptions.

- Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF) for use in fire-fighting foam for liquid fuel vapour suppression and liquid fuel fires (Class B fires).[29] Of note is the fact that the acceptable purpose stated in the Convention document includes the phrase "in installed systems". Information collected in the firefighting foam inventory conducted for this NIP shows that PFOS is present locally in firefighting foam concentrate which is purchased in plastic drums and converted into foam as required. Clarification will be needed from the Convention Secretariat as to whether the specific exemption will be applicable to

firefighting foam held in the form of foam concentrate, as opposed to “installed systems”. This specific exemption for PFOS is available until 2022.

As stated in section 3.3.2, while it is known that SCCPs are imported, it was difficult to determine the local applications. These will be assessed and the required specific exemptions registered; this option is available until 2023. The Convention entered into force for SCCPs in 2018 (they were listed to Annex A in 2017 with a number of permitted uses), however as at March 2023, only Viet Nam has registered for specific exemptions for these substances.

Actions needed to obtain specific exemptions are shown in Table 3.7.

**Table 3.7: Measures to secure specific exemptions as necessary**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs (Cost US$) |
|---|---|---|---|---|---|
| Establish a participatory and informed process for registration of specific exemptions | Stakeholder consultation to explain the process and mechanism<br>Assess the need for exemptions for PFOS, PFOA | Consultations held; decisions taken | 1 year | MEGJC, MFAFT,<br>users of POPs-containing articles and products | HR |
| | Assess the need for exemptions for SCCPs and for POPs listed in Annexes A and B in the future | Consultations held; decisions taken | 1 year and then ongoing | | HR |
| Register specific exemptions as deemed necessary | Notify Convention Secretariat | Exemptions listed | 1 year and then ongoing | MEGJC, MFAFT | HR |

### 3.3.8 ACTIVITY: MEASURES TO REDUCE RELEASES FROM UNINTENTIONAL PRODUCTION (ARTICLE 5)

Unintentional Persistent Organic Pollutants (UPOPs) in Jamaica are generated primarily from activities that involve the burning of waste and also from the disposal of wastewater and sewage effluent that has been disinfected using chlorine. The open-burning processes subcategory contributes the highest releases of PCDD/PCDF to air. This is likely due to the prevalence of open/backyard burning coupled with poor disposal site management in Jamaica. The disposal source group has the highest PCDD/PCDF value. The main contributors to this group are dumpsites and wastewater treatment plants, with the single largest source of PCDD/PCDF found in wastewater residues. Jamaica must therefore develop strategies to manage PCDD/ PCDF emissions associated with waste and wastewater disposal, open burning, production of mineral products and waste incineration.

There were several data gaps in the inventory conducted for the NIP because agencies that should be collecting necessary information were either not collecting the data at all, were only collecting a part of the information which was not useful or were not collecting the data in a useful format. The action plan, therefore, focuses on two areas.

1. Improvements to data collection recognising that the lack of good data poses a risk to a robust and comprehensive action plan to reduce and better manage UPOPs
2. Actions required to reduce the generation of UPOPs. These include a number of measures that fall into the categories of Institutional and Legislative Strengthening and Public Education. Objectives and actions in these categories that relate to UPOPs are covered in this section, and overlaps with measures described in other sections (Tables 3.1 and 3.12) are indicated.

**3.3.8.1 Action Plan to Improve Collection and Management of Data for UPOPs Inventories** One key step would be to establish a Government Clearing House for data that is required for not only the Stockholm Convention reporting requirements but for other Conventions as well. The format of the data and the frequency of input would be established and respective Agencies would have to upload the information as required. The Clearing House would need to be managed to ensure that it facilitates the input of data as required and that reporting is done by Agencies in compliance with the requirements and on the established frequency.

Basic local research is needed for confident estimates and accurate inventories. Instead of relying on data from studies conducted in other countries, which may or may not be applicable to the Jamaican situation, there should be local studies to determine quantities of biomass consumed under various open-burning scenarios.

The UPOPs inventory should be carried out on a three or four-year cycle. Trends could thus be observed and meaningful conclusions drawn. Agencies would then need to integrate the data collection into their normal operations; the requirement for provision of data infrequently and unpredictably is disruptive and onerous. Measures proposed to improve data collection are shown in Table 3.8 following.

**Table 3.8: Measures to meet the objective of improving the collection and management of data for UPOPs inventories**

| | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| 1. | Establish a Government database or Clearing House to facilitate the upload of data and information by the relevant public sector agencies to inform, *inter alia*, reporting under Conventions, Protocols and Treaties with appropriate data management oversight | A Government database or Clearing House established | 2 years to establish a Clearing House and ongoing management thereafter | MEGJC, MOAF, MLGRD, NEPA, RADA, Forestry Department, JFB, STATIN | HR:<br>• Task Force or Steering Committee to oversee establishment of Clearing House<br>Financial:<br>• Consultancy services to establish a Clearing House<br>• MEGJC's recurrent budget for ongoing activities | Consultancy services<br>85,000 |
| 2 | STATIN to collect information required for UPOPs Inventory; annual production of lime; census - quantity of household waste composted; annual usage of kerosene, LPG, wood and coal | Additional information included in next census; annual lime production<br>data published on STATIN website | 2 years to incorporate additional information; ongoing<br>thereafter | STATIN, MEGJC | HR: STATIN | |

| | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| 3 | Conduct research into the amount of biomass consumed per hectare for clearing of land for agricultural purposes (RADA); forest fires (Forestry Department); bushfires (JFB) | Locally developed data for biomass consumed/burned under various scenarios | 3 years to conduct research and generate local data; ongoing data collection and compilation annually | MEGJC, RADA, Forestry Department, JFB, UWI/UTECH/CASE, FAO, IICA | HR:<br>• Task Force or Steering Committee to oversee establishment of Clearing House<br>Financial:<br>• Consultancy services to establish Clearing House<br>• MEGJC's recurrent budget for ongoing activities | Consultancy services<br>85,000 |
| 4 | Achieve better compliance with environmental reporting requirements. (wastewater, sewage, air emissions). Reporting on the annual effluent discharge to the environment and the annual quantity of sludge generated and how it is handled/disposed of<br><br>Reporting of annual air emissions including Priority Air Pollutants (PAPs) which includes POPs | Annual effluent discharge data and annual quantity of production of sludge data routinely collected for 70% of WWTPs and STPs<br><br>Annual air emissions reports including Priority Air Pollutants (PAPs) which include POPs for 90% of licenced facilities | 3 years to achieve target and ongoing work towards 100% | NEPA, NWC, HAJ, WWTP and STP Operators<br><br>Operators of NEPA-licenced facilities with air emissions | HR: NEPA, NWC | |

| | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| 5 | Identify incinerators and collect data on types and quantities of waste burnt | Incinerators identified | 2 years | MEGJC, MLGRD, NEPA, Municipal Corporations | HR: Municipal Corporations<br>Finance: Consultancy Services | Consultancy services per parish<br>10,000 |
| 6 | Ministry of Science, Energy and Technology to refine annual energy statistics to facilitate easy utilisation in UPOPs inventory calculations | Data refined in accordance with UPOPs inventory requirements | 1 year | MSET, MEGJC | HR: MSET | |

#### 3.3.8.2 Action Plan to Reduce UPOPs and Improve Management of Sources

The actions to minimise UPOPs comprise a mixture of interventions to encourage behaviour change and the use of technology. Behaviour change is usually achieved through the use of legal instruments, economic instruments and education.

*Legal and Economic Measures* - Open burning and the consequent releases of UPOPs to the environment should be priority issues in the government's updated policy on the management of POPs. The lead ministry in this matter is the MEGJC. Situations of open burning can vary across sectors, so a multiagency Task Force comprising stakeholders with roles in the reduction of UPOPs (and co-opting others as necessary) should be established. The aim would be the development of recommendations and strategies for control measures that take account of the challenges encountered across the sectors. The actions that entail the use of legal and economic measures to reduce emissions of UPOPs are included in Table 3.1.

*Education and Technological Change* – Behaviour change is brought about most effectively through education. Education, in this context, is public education and sector-specific education, and public education must include the provision of alternatives to offending activities. Enforcement action is reserved for those individuals who despite being educated and provided with alternatives still decide to flout the law. Sufficient resources are therefore needed for a sustained 3–5-year public education

campaign. The actions that entail public education to reduce emissions of UPOPs are included in Table 3.12.

Some alternatives to the burning of waste will require citizens, especially those in rural areas where garbage is not collected, to manage waste differently. Alternatives to dumping and burning include community recycling centres and composting facilities. Emphasis must be placed on the separation of waste at source to remove plastic (burning of which is a significant source of UPOPs) from the waste stream. The NSWMA has a major role in these activities and must be adequately resourced to carry out the education function.

Another important area of focus is the technology used for disinfection of wastewater. Chlorine disinfection lends itself to the generation of PCDD/PCDF in effluent and sludge which are disposed of in receiving water bodies and on land. Other effective disinfection methods such as UV disinfection should be promoted by NEPA and the MOHW-EHU as a strategy to reduce UPOPs from these sources. This change which requires a technological shift will have an attendant cost so, it may take some time for the change to be effected.

The disposal sites across the island constitute a major source of UPOPs. There are frequent fires at these sites – caused by spontaneous combustion, arson, or waste pickers trying to access useful or valuable materials. If the disposal sites are upgraded to sanitary landfills, these issues will be alleviated. The Enterprise Team established by the Development Bank of Jamaica (DBJ) is currently tasked by the GOJ with spearheading improvements to solid waste management in Jamaica. Two major initiatives include:

- The identification of lands for the construction of a sanitary landfill to replace the Riverton Disposal site
- The environmentally acceptable closure of the Riverton Disposal site

Legislative measures for meeting the objective of reducing UPOP releases are included in Table 3.1 and other measures are summarized in Table 3.9.

**Table 3.9: Measures to meet the objective of reducing UPOP releases**

| | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| 1. | Increase collection centres for recyclable plastics especially in rural townships to reduce the incidence of plastic burning | Recycling /collection centres in parish capitals and at least 2 rural towns in each parish | 2 - 3 years to establish recycling centres, ongoing monitoring thereafter | NSWMA, NEPM, SPM, WPM, MPM, Municipal Corporations, Private sector entities, MLGRD, NGOs, ODPEM | Financial:<br>To establish recycling centres<br>• Consultancy services<br>• Public-private partnership<br>Ongoing monitoring<br>HR: NSWMA | Consultancy Services<br>70,000*<br>Collection centres 1.8M |
| 2. | Set up community composting projects so that biodegradable waste is put to a useful purpose | Community composting projects in at least 2 rural towns in each parish | 2 - 3 years | NSWMA, NEPM, MPM, SPM, WPM, Municipal Corporations, Private sector entities, MLGRD, NGOs, | Financial:<br>To establish community composting projects<br>• Consultancy services<br>• Public-private partnership<br>Ongoing monitoring<br>HR: NSWMA | Consultancy Services 70,000* |
| 3. | Develop a comprehensive public education programme around municipal waste management that not only educates about the hazards associated with dumping but also includes the health and environmental hazards associated with burning of garbage and provides alternatives such as composting and recycling. Campaign to run for at least 3 years. (Table 3.12) | Public education programme designed and implemented | Development 1.5 years; Implementation 3 years | NSWMA, NEPM, MPM, SPM, WPM, Municipal Corporations MLGRD, NGOs, JFB and MOHW (Environmental Health Unit), Regional Health Authorities | Financial:<br>Consultancy services to develop and implementation<br>HR: NSWMA to oversee consultancy and for ongoing activities | Consultancy services 25,000 |

| | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| 4. | Establish with the stakeholders in the sugar industry (SIA, SIRI, RADA etc.) when burning of sugarcane fields for reaping will be phased out. This will need to be accompanied by special education and outreach programmes with small farmers who are predominantly still using this practice for reaping. | Schedule for phase-out of cane burning established, not to exceed 3 years. Cane farmers utilising alternatives. | 2 years | MOAF, SIA, SIRI, RADA, NEPA | HR: Task Force or Steering Committee | |
| 5. | NEPA to educate stakeholders and encourage the use of effective disinfection methods other than chlorination to reduce the formation of UPOPs in WWTP effluent and residues | Alternative disinfection methods employed in 60% of wastewater & sewage treatment plants | 6 years | NEPA, MOHW-EHU, NWC, HAJ, WWTP and STP Operators | HR: Task Force or Steering Committee | |
| 6. | Upgrade existing disposal sites to operate as landfills or construct new sanitary landfills | Riverton and Retirement have state-of-the-art sanitary landfills; other sites operations upgraded to prevent unauthorised fires and spontaneous combustion | 5 -7 years | OPM, MLGRD, NSWMA, NEPM, MPM, SPM, WPM | Enterprise Team for Waste Management Reform Programme | Project costs already quantified |

*these are the same

### 3.3.9 ACTIVITY: IDENTIFICATION AND MANAGEMENT OF STOCKPILES, WASTE AND ARTICLES IN USE, INCLUDING RELEASE REDUCTION AND APPROPRIATE MEASURES FOR HANDLING AND DISPOSAL

Pesticides constitute 18 of the 30 POPs. No POPs pesticides are currently used in Jamaica and all known waste and major stockpiles of these chemicals were exported for disposal in 2017. There are, however, reports of POPs pesticides among unclaimed imported chemicals stored by the Jamaica Customs Agency; it is not known if these are stored under appropriate conditions, but they are monitored and mechanisms exist for transfer to secure storage, if necessary, and subsequent disposal.

Out-of-service PCB-containing equipment is stored at a secure site from which it is unlikely that releases to the environment will occur. A clearer picture of the condition of all in-service PCB transformers is needed to determine if releases are occurring from these sources; those observed in the inventory for this NIP were in good condition.

There are stockpiles of firefighting foam concentrate that contain PFOS, held by entities with firefighting capability. It is proposed that these remain in situ while plans for consolidation and disposal are developed.

In the Jamaican context, approaching the obligations of Article 6 of the Convention turns on the management of those consumer articles and products containing industrial chemicals (PCBs, brominated flame retardants, PFOS, PFOA) as they enter the waste stream, separation of these hazardous wastes from other waste and their ultimate destruction. These articles and products and the POPs they contain are listed below:

- Fluorescent light ballasts manufactured before 1980 (PCBs)
- Other electrical and electronic equipment manufactured before 2004 (POP brominated flame retardants, BFRs)
- Plastic and PUR foam from interiors of vehicles manufactured before 2004 (POP BFRs)
- Synthetic carpets manufactured before 2006 (PFOS)
- Extruded polystyrene (EPS) and expanded polystyrene (XPS) manufactured before 2014 (HBCD)

The *National Policy for the Environmentally Sound Management of Hazardous Wastes (Green Paper*) and the implementation road map contained therein provide context and guidance. Real requirements are modalities for sorting and segregated storage of the groups of POPs wastes, capability for destruction, and behavioural change through education of stakeholders and the public – the challenges to the latter being considerable. Table 3.10, following, refers.

**Table 3.10: Identification and management of stockpiles, waste and articles in use, including release reduction and appropriate measures for handling and disposal**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| Identification of:<br>• current local options and capacity for POPs destruction;<br>• future needs for POPs destruction. | • compile a database of incinerators and cement kilns, with specifications<br>• conduct a needs assessment of destruction capacity | Local destruction capacity documented<br>Needs assessment report | 2 years | *MEGJC*,<br>NEPA<br>NSWMA | Finance, technical expertise, HR | Consultancy<br>30,000* |
| Evaluation of other measures for ESM of POPs stockpiles and wastes | Compile a detailed report on ESM for POPs stockpiles and feasibility in the local context | Documentation of ESM options | 2 years | *MEGJC*,<br>NEPA<br>NSWMA | Finance, technical expertise, HR | Consultancy<br>30,000* |

| | | | | | | |
|---|---|---|---|---|---|---|
| Collection of POPs waste, and safe handling and storage (within the ambit of the NRCA Permits and Licences Regulations) | • Develop a public education program on the hazards, handling and safe storage of POPs waste (Table 3.12)<br>• Train Waste Management Authority personnel in procedures for segregation and safe handling of POPs waste and supply the necessary equipment<br>• Identify one or more sites for temporary storage of POPs waste in each of the Waste Management Authorities, label and secure the sites<br>• Institute schemes for collection, including establishment of collection sites | Media campaign launched<br><br>Training program in place; personnel trained<br>Sites identified and secured<br><br>Collection schemes instituted and sites established; vehicles & specialized equipment purchased | 3 years | MEGJC, NEPA, MOHW-EHU, NSWMA, JIS, Consumer, Affairs Commission | Finance, technical expertise, HR, Training | 40,000<br><br>800,000 |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| Environmentally sound destruction of POPs | • Destruction locally, where feasible<br>• Export of POPs waste for destruction, where necessary | POPs waste eliminated and the quantities documented | 4 years | MEGJC, NEPA NSWMA | Finance, technical expertise, HR | Costs depend on methods and quantities |

**these are the same*

### 3.3.10 ACTIVITY: IDENTIFICATION OF CONTAMINATED SITES AND, WHERE FEASIBLE, REMEDIATION IN AN ENVIRONMENTALLY SOUND MANNER

There are no sites known to be contaminated with POPs pesticides. During the course of the PCB inventory, a report of one PCB-contaminated site was received. That location is now covered with asphalt and functions as a car park. Discarded items containing POPs industrial chemicals, such as the items listed in the previous section, are not separated from other waste by householders and most institutions. These POPs-containing items become municipal waste and are dispersed across the eight solid waste disposal sites in Jamaica, all of which could be deemed to be POPs-contaminated sites. Remediation of these sites is probably not feasible.

There are at least 25 sites that may be contaminated with PFOS from the use of firefighting foam in actual fire events and in training exercises. A list of these locations (with coordinates from Google maps) was developed in the preliminary PFOS inventory for this NIP. At the very least, analytical data is needed to (a) definitively establish PFOS contamination at each site, and (b) determine the extent of contamination where present. Other possible POPs-contaminated sites are those at which quantities of waste electrical and electronic equipment (WEEE) are stored by the NSWMA. Proposed measures for identification and management of possible contaminated sites are shown in Table 3.11.

**Table 3.11: Measures for identification of contaminated sites and, where feasible, remediation in an environmentally sound manner**

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| Identify, document and prioritize POPs-contaminated sites | Refine the preliminary inventories of possible POPs-contaminated sites | Upgraded and refined inventory report; sites definitively identified | 2 years | MEGJC NEPA, NSWMA | HR, finance, training, technical expertise | Consultancy 40,000 |
| | Develop criteria for definitions of contaminated sites | Criteria defined and guidelines on identification developed | 2 years | MEGJC NEPA, NSWMA | | |
| | Establish a database of sites, including a pollution map that can be integrated with existing relevant local databases | Database established; sites mapped; pollution map available; sites prioritized for further assessment and cleanup | 3 years | MEGJC NEPA, NSWMA, Mona Geoinformatics Institute, ICENS | | |
| | Develop the technical capability for analysing PFOS and POP BFRs | Equipment purchased; personnel trained; analytical capability established | 3 years | MEGJC NEPA, UWI, UTECH, ICENS | HR, finance, equipment, training, technical expertise | 700,000 |
| | Analyse soil and groundwater samples for POPs from possible contaminated sites | Analytical data available | 4 years | MEGJC NEPA, UWI, UTECH, ICENS | HR, analytical services | 30,000* |
| Management and risk assessment of contaminated sites and remediation, where feasible | Train personnel in identification and management of contaminated sites and safe handling of materials | Workshops conducted; staff trained | 2 years | MEGJC NEPA, NSWMA, JFB | HR, finance, training | 35,000 |

| Objectives | Actions | Success Indicators | Time Frame | Lead & Other Agencies | Resource Needs | Estimated Cost US$ |
|---|---|---|---|---|---|---|
| | Secure, label, and restrict activities at contaminated sites to minimize exposure to humans and environmental releases | Procedures developed; sites clearly identified and isolated | 3 years | MEGJC<br>NEPA, NSWMA, JFB | HR, finance, training | 10,000 |
| | Assess exposure risk of individuals and communities that operate in proximity to the sites through chemical analysis | Levels of POPs residues measured in samples of human tissues and fluids, plants, soil, and water, from contaminated sites | 4 years | MEGJC<br>JFB, MOAF, MOHW, NEPA, NSWMA, UWI, UTECH, ICENS | HR, technical expertise, finance | 30,000* |
| | Identify and assess remediation technologies, and apply these where feasible | Remediation options identified and executed where feasible | 5 years | MEGJC<br>NEPA, JFB, industry stakeholders | HR, technical expertise, finance | Costs to be borne by the industry stakeholders |

** these are the same*

### 3.3.11 FACILITATING OR UNDERTAKING INFORMATION EXCHANGE AND STAKEHOLDER INVOLVEMENT

Effective management of POPs entails several agencies because of the diverse applications, origins and occurrence of these chemicals. At the national level, the exchange of information within and between the agencies concerned is therefore critical. The strategies proposed in the 2005 NIP for this information exchange are even more relevant now than they were then, given the increased number of POPs and applications. The primary strategy is regulatory – inclusion of detailed specifications for reporting within regulations and guidelines. Specifications include: the person responsible for providing the report, schedule, content, and recipient. Where regulations cannot apply between agencies or are not yet in place, the use of memoranda of understanding for sharing of mutually beneficial information should be explored. Table 3.1 incorporates this objective and associated actions.

Article 9 of the Convention requires that each Party should facilitate the exchange of information on POPs with other Parties, directly or through the Convention Secretariat. The web page proposed in section 3.2.1 should serve as a repository of national information on POPs. Salient content should be compiled periodically and submitted to the Convention Secretariat for publication on their website.

### 3.3.12 ACTIVITY: PUBLIC AND STAKEHOLDER AWARENESS, INFORMATION AND EDUCATION (ARTICLE 10)

The Public Education and Corporate Communications Branch of NEPA could be tasked with managing this critically important aspect of the NIP. Awareness of POPs issues is moderately high among the small group of public sector stakeholders, safety professionals, and those from the manufacturing and science-based industrial sector who participated in the NIP workshops. However, a large segment of the Jamaican population across all socioeconomic groups and educational levels know or care very little about chemical safety and, by extension, POPs. This lack of knowledge is demonstrated in ways such as:

- widespread burning of waste, even in upscale residential communities,
- wide availability of bulk household chemicals (bleach, fabric softener, disinfectant) repackaged for retail in unlabelled and unsuitable containers,
- use of illegally imported and unsafe cosmetics (bleaching creams, hair straightening chemicals).

After the Occupational Safety and Health Bill (The Occupational Safety and Health Act, 2017 draft) is enacted, there will be a need for further human resource development in occupational safety and health (and, by extension, chemicals management) for workplace monitoring for compliance with the provisions of the new legislation. This will create opportunities for increasing awareness of POPs and underscores the necessity for relevant training modules in TLIs.

Different strategies will be required for:

- Increasing stakeholder awareness and information on POPs
- Increasing public awareness and information on POPs
- Introducing content on POPs in educational programmes

and approaches must be fine-tuned to specific target groups and classes of POPs.

The objectives shown in Table 3.12 below are derived from Article 10 of the Convention and the proposed actions take account of the foregoing factors.

**Table 3.12: Measures to increase public and stakeholder awareness, information and education (Article 10)**

| Objective | Action | Success Indicators | Time Frame | Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Raise awareness of POPs issues among policy and decision-makers | Identify relevant policy and decision-makers and influencers<br>• CEOs of agencies involved in POPs management<br>• top tier education officials and academics<br>• leaders of professional organizations<br>Organize and run seminars, workshops and short courses | Stakeholders identified<br>Training programmes organized and delivered | 1.5 years | NEPA<br>MEGJC<br>BRS Secretariat<br>All agencies involved in POPs management | HR from the participating MDAs,<br>consultants | 15,000 |
| Train technical and managerial personnel in specific aspects of POPs management | Identify target groups for classes of POPs<br>• PCBs – personnel from entities visited for inventory + others<br>• PFAS – entities with firefighting capability<br>• BFRs – Waste Management Authorities<br>• UPOPs – Waste Management Authorities, Municipal Councils, Forestry Dept., HAJ, ITA, MLGRD, NWC, RADA, SIA, STP & WWTP operators<br>Design, organize and deliver a structured course (with certification) with a general module on all POPs & modules specific to each group of POPs. Include content on disinfection methods other than chlorination to reduce UPOP formation in | Course organized and delivered | 1.5 years | NEPA<br>MEGJC<br>BRS Secretariat | HR from the participating MDAs, consultants | 30,000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | WWTP effluent & residues | | | | | |

| Objective | Action | Success Indicators | Time Frame | Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Development and dissemination of public awareness materials on POPs | Produce, distribute and publish material on POPs for<br>• Posters and billboards<br>• Radio and television<br>• Print media<br>Conduct surveys (before and after) to assess the impact of the campaign<br><br>Develop a comprehensive public education programme around municipal waste management to include information on<br>• hazards associated with dumping<br>• health and environmental hazards of burning garbage<br>• alternatives such as composting and recycling<br>Campaign to run for at least 3 years (Table 3.8) | Material produced, distributed, published<br><br>Data from surveys<br>Public education programme designed and implemented | 3 years<br>Development – 1.5 years<br>Implementation - 3 years | NEPA,<br>MEGJC,<br>JIS,<br>NSWMA, NEPM, MPM, SPM, WPM, Municipal Corporations, MLGRD, NGOs | HR from the participating MDAs,<br>consultants, public relations expertise<br>Consultancy services for development and implementation;<br>HR from the participating MDAs to oversee consultancy and for ongoing activities | 70,000*<br><br>25,000<br>(repeated from Table 3.9) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Development and implementation, especially for women, children and the least educated, of educational and awareness programmes on POPs and health and environmental effects | • Identify and target relevant community groups in each parish<br>• Identify and target communities close to each of the eight official disposal sites<br>Develop appropriate instructional material in partnership with leading women's groups.<br>Conduct seminars and workshops island-wide.<br>Carry out surveys (before and after) to assess the impact of the programmes | Groups identified<br>Instructional material produced<br>Seminars/ workshops conducted<br>Gender mainstreaming of POPs issues | 3 years | NEPA,<br>MEGJC,<br>SDC,<br>NSWMA<br>Ministry of Culture, Gender, Entertainment and Sport | HR from the participating MDAs,<br>consultants | 70,000* |

| Objective | Action | Success Indicators | Time Frame | Agencies | Resource Needs | Cost (US$) |
|---|---|---|---|---|---|---|
| Development and implementation of education and training programmes at the national and regional levels | 1. Survey the following curricula<br>• Primary school to PEP (grades 1-6)<br>• Secondary school (grades 7-9)<br>• CSEC<br>• CAPE<br>and assess the content that addresses environmental issues for relevance to POPs<br>2. Make recommendations to the Ministry of Education and Youth (MOEY) and the Caribbean Examinations Council for inclusion of appropriate content in each syllabus | Curricula surveyed and assessed<br>Report written<br>Recommendations conveyed to MOEY and CXC | 2 years | NEPA,<br>MEGJC,<br>MOEY | HR from the participating MDAs,<br>consultancy services | 10,000 |
| | 1. Create a course module for TLIs on the MEAs to which Jamaica is a signatory, with emphasis on the effects and management of the pertinent chemicals<br>2. Make the course module freely available to all national and regional TLIs, including teacher training institutions | Course created, written, and distributed | 2 years | NEPA<br>MEGJC<br>BRS Secretariat | HR from the participating MDAs,<br>consultancy services | 10,000 |

*these are the same

### 3.3.13 ACTIVITY: EFFECTIVENESS EVALUATION (ARTICLE 16)

Under this Article the effectiveness of the Convention is to be evaluated by regions, using harmonized approaches and monitoring programmes established by the Conference of the Parties. The main mechanism of this evaluation is the Global Monitoring Programme (GMP) which has undergone two cycles, GMP1 (2010-2014) and GMP2 (2015-2019). Both GMPs measured levels of POPs in the environment and in human blood and breast milk. Jamaica, through the Pesticides Research Laboratory, UWI,

participated in the GRULAC segments of both GMP1 and GMP2; this participation was facilitated by technical and financial support from UNEP. The local implementing laboratory has experienced recent losses of critical personnel and equipment and as a result, is unlikely to be able to mount an independent POPs monitoring programme in the immediate future. Continued evaluation of the effectiveness of the Convention in the near term will therefore depend on the availability of technical and financial support via a third round of the GMP or a similar programme.

#### 3.3.14 ACTIVITY: REPORTING (ARTICLE 15)

In conformance with the requirement of this Article for submission of reports to the Conference of the Parties on in-country measures taken for implementing provisions of the Convention, Jamaica made a submission during the third round of Party reports. Activities under the updated NIP will result in compliance with subsequent amendments to the Convention, necessitating additional reports. No impediments to preparing and conveying these reports are envisaged.

#### 3.3.15 ACTIVITY: RESEARCH, DEVELOPMENT AND MONITORING (ARTICLE 11)

There is a real need for an ongoing monitoring programme for POPs in the local environment. The current technical infrastructure enables analysis of pesticides and PCBs; significant capital outlay is necessary to acquire capability for PFAS analysis. Despite the limitations, it should be possible to execute carefully designed collaborative research-type projects (distinct from the GMPs) the results of which could:

a. provide information for risk assessment and safeguarding health of affected communities;
b. contribute to the body of knowledge on environmental transport of POPs;
c. have scientific merit;
d. serve as a training ground for students of environmental science.

Two of the research and monitoring projects proposed in the 2005 NIP remain relevant and are listed below:

i. Establish the levels of POPs and other pesticides in coastal waters, sediments, streams and soil with priority given to food-producing (agriculture, fishing) and recreational areas (marine parks, Kingston Harbour). The monitoring program should be coordinated with pesticide residue monitoring.
ii. Conduct a survey of the levels of dioxins and furans in selected environmental media (sewage sludge, cement kiln dust including dump sites), agricultural soils from sugar cane fields, waste disposal sites subjected to periodic fires, selected sediments (Kingston Harbour), etc. The results of the survey should indicate whether or not additional studies are needed.

Monitoring for PFAS in potentially contaminated sites and in water should be part of the regulatory requirements for POPs management. This underscores the need to acquire analytical capability for PFAS.

## 3.4 DEVELOPMENT AND CAPACITY-BUILDING PROPOSALS AND PRIORITIES

Implementation of the NIP will require significant improvements and efforts in four cross-cutting areas, listed below in decreasing order of priority. This priority listing is based on national needs, assessed during the NIP development process, and Convention requirements:

A. The regulatory and institutional framework (Table 3.1)

B. Public information, awareness and education (Table 3.12)

C. Control of releases of all POPs by enhancing infrastructure and use of alternative technologies including:
   - capacity (waste collection equipment and vehicles) for additional and specialised waste collection;
   - collection centres for recyclable plastics;
   - landfill sites;
   - hazardous waste disposal sites;
   - use of alternatives to chlorine for disinfection of effluent.

D. Capacity for monitoring of POPs – laboratory capacity for analysis of PFAS and BFRs

## 3.5 TIMETABLE AND RESOURCE REQUIREMENTS FOR THE IMPLEMENTATION STRATEGY

Actions, success indicators, time frames and requirements for achievement of specific action plans are given in Tables 3.1-3.12. Table 3.13, below, provides an overview and summary of the timetable and resource requirements.

The cost of implementation of the NIP is estimated at US$5,536,000, exclusive of the cost of landfills and of disposal and remediation costs.

**Table 3.13: Timetable and resource requirements for the implementation strategy**

| | Year1 | | | | Year 2 | | | | Yr 3 | Yr 4-5 | Yr 6-7 | Cost US$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | | | | |
| PRIORITY ACTIONS AND NEEDS | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **A. Institutional and Regulatory Strengthening Measures** | | | | | | | | | | | | |
| PERSONNEL: 10 full-time equivalents (FTEs) over 7 years (mid-level government compensation packages estimated at US$20,000 annually) | | | | | | | | | | | | 1,400,000 (HR cost)* |
| Formalize a coordinating mechanism for POPs management in the public sector | | | | | | | | | | | | *HR costed above |
| Harmonize the roles of the institutions that influence the formation of UPOPs | | | | | | | | | | | | 25,000 |
| Legislate the separation of POPs waste from municipal waste | | | | | | | | | | | | *HR costed above |
| Ensure that legislation in draft is consistent with the provisions of the Stockholm Convention with respect to brominated flame retardants | | | | | | | | | | | | *HR costed above |

| | Year1 | | | | Year 2 | | | | Yr 3 | Yr 4-5 | Yr 6-7 | Cost US$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | | | | |
| Ensure that import policies for articles containing POP BFRs are consistent with Stockholm Convention provisions for these chemicals | | | | | | | | | | | | *HR costed above |
| Harmonize and strengthen the legislation that impacts on generation of UPOPs | | | | | | | | | | | | 45,000 (all legal activities) |
| Establish a Government database or Clearing House to facilitate the upload of data and information by the relevant public sector agencies to inform, *inter alia*, reporting under Conventions, Protocols and Treaties with appropriate data management oversight | | | | | | | | | | | | 85,000 |
| Strengthen border control (operationally) for import of POPs and other hazardous chemicals | | | | | | | | | | | | 20,000 |
| Legislate: (a) the prohibition of POPs not currently prohibited; (b) levels of POPs in wastewater, sludge & drinking water | | | | | | | | | | | | *HR costed above |
| Complete the drafting of the omnibus chemicals legislation and promulgate the Act | | | | | | | | | | | | *HR costed above |
| | | | | | | | | | | | | |
| **B. Measures to Increase Public and Stakeholder Awareness, Information and Education** | | | | | | | | | | | | |
| Raise awareness of POPs issues among policy and decision-makers | | | | | | | | | | | | 15,000 |
| Train technical and managerial personnel in specific aspects of POPs management | | | | | | | | | | | | 30,000 |
| Develop and implement education and training programmes (primary, secondary and tertiary) at the national and regional levels | | | | | | | | | | | | 20,000 |
| Develop a comprehensive public education programme around municipal waste management | | | | | | | | | | | | 25,000 |

| | Year1 | | | | Year 2 | | | | Yr 3 | Yr 4-5 | Yr 6-7 | Cost US$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | | | | |
| Execute the municipal waste management public education programme | | | | | | | | | | | | Costing above |
| Develop and disseminate public awareness materials on POPs | | | | | | | | | | | | See below |
| Develop and implement, especially for women, children and the least educated, educational and awareness programmes on POPs and health and environmental effects | | | | | | | | | | | | 70,000 (all POPs-specific public education) |
| **C. Control of releases of all POPs by enhancing infrastructure and use of alternative technologies** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Increase collection centres for recyclable plastics, especially in rural townships, to reduce the incidence of plastic burning | | | | | | | | | | | | 1,870,000 |
| Set up community composting projects so that biodegradable waste is put to a useful purpose | | | | | | | | | | | | Included in the cost above |
| Identification and management of stockpiles, waste and articles in use, including release reduction and appropriate measures for handling and disposal | | | | | | | | | | | | 870,000 |
| Educate stakeholders and encourage the use of effective disinfection methods other than chlorination to reduce the formation of UPOPs in WWTP effluent and residues | | | | | | | | | | | | (included in other costs) |
| Upgrade existing disposal sites to operate as landfills or construct new sanitary landfills | | | | | | | | | | | | Quantified elsewhere (DBJ)[31] |
| **D. Capacity for monitoring of POPs – laboratory capacity for analysis of PFAS and BFRs** | | | | | | | | | | | | |

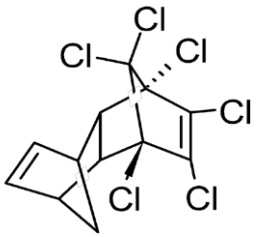
| | Year1 | | | | Year 2 | | | | Yr 3 | Yr 4-5 | Yr 6-7 | Cost US$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | | | | |
| Develop the technical capability for analysing PFOS and POP BFRs | | | | | | | | | | | | 700,000 |
| **SUB-TOTAL FOR PRIORITY ACTIONS & NEEDS** | | | | | | | | | | | | 5,175,000 |
| **OTHER ACTIONS AND NEEDS** | | | | | | | | | | | | |
| Request and obtain specific exemptions as necessary | | | | | | | | | | | | *HR costed above |
| Reduce or eliminate releases from intentional production and use (HCBD, PCN, SCCP) | | | | | | | | | | | | 15,000 |
| Identification, labelling, removal, storage, and disposal of PCBs and equipment containing PCBs | | | | | | | | | | | | 6,000 |
| Eliminate import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF and of PFOA | | | | | | | | | | | | (included in other costs) |
| Collection and management of data for UPOPs inventories | | | | | | | | | | | | 225,000 |
| Identification of contaminated sites and, where feasible, remediation in an environmentally sound manner | | | | | | | | | | | | 115,000* |
| **SUB-TOTAL FOR OTHER ACTIONS & NEEDS** | | | | | | | | | | | | 361,000 |
| **GRAND TOTAL** | | | | | | | | | | | | **5,536,000** |

*Remediation costs not quantified; to be borne by industry stakeholders

## ANNEX 1 – SUPPORTING INFORMATION ON POPS[26]

### 1. Aldrin

CAS No: 309-00-2

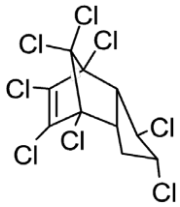
Structure: 


**Use and production -** A pesticide applied to soils to kill termites, grasshoppers, corn rootworms, and other insect pests, aldrin can also kill birds, fish, and humans.

**Adverse Effects -** In one incident, aldrin-treated rice is believed to have killed hundreds of shorebirds, waterfowl, and passerines along the Texas Gulf Coast when these birds either ate animals that had eaten the rice or ate the rice themselves. In humans, the fatal dose for an adult male is estimated to be about five grams. Humans are mostly exposed to aldrin through dairy products and animal meats. Studies in India indicate that the average daily intake of aldrin and its by-product dieldrin is about 19 micrograms per person.

### 2. Chlordane

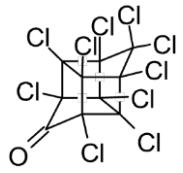
CAS No: 57-74-9

Structure: 

**Use and production -** Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops, chlordane remains in the soil for a long time and has a reported half-life of one year.

### 3. Chlordecone

CAS No: 143-50-0

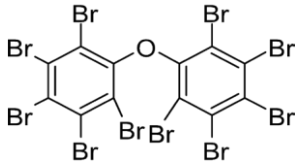
Structure: 

**Use and production -** Chlordecone was mainly used as an agricultural pesticide. It was first produced in 1951 and introduced commercially in 1958. Currently, no use or production of the chemical is reported.

### 4. Decabromodiphenyl ether (c-decaBDE)

The commercial mixture consists primarily of the fully brominated decaBDE congener in a concentration range of 77.4-98 %, and smaller amounts of the congeners of nonaBDE (0.3-21.8 %) and octaBDE (0-0.04 %).

CAS No: 1163-19-5

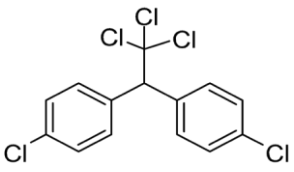
Structure: 

**Use and Production -** DecaBDE is used as an additive flame retardant and has a variety of applications including in plastics/polymers/composites, textiles, adhesives, sealants, coatings and inks. DecaBDE-containing plastics are used in housings of computers and TVs, wires and cables, pipes and carpets. Commercially available decaBDE consumption peaked in the early 2000s, but c-decaBDE is still extensively used worldwide.

**Adverse Effects -** Adverse effects are reported for soil organisms, birds, fish, frogs, rats, mice and humans.

## 5. Dichlorodiphenyltrichloroethane (DDT)

CAS No: 50-29-3

Structure: 

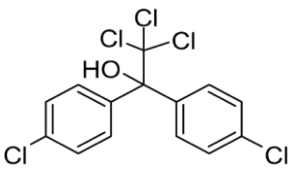
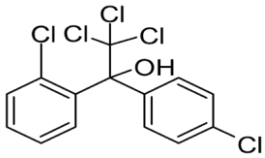
**Use -** DDT was widely used during World War II to protect soldiers and civilians from malaria, typhus, and other diseases spread by insects. After the war, DDT continued to be used to control disease, and it was sprayed on a variety of crops, especially cotton. DDT continues to be applied against mosquitoes in several countries to control malaria.

**Adverse Effects –** Perhaps the best-known toxic effect of DDT is egg-shell thinning among birds, especially birds of prey. Its impact on bird populations led to bans in many countries during the 1970s. The short-term acute effects of DDT on humans are limited, but long-term exposures have been associated with chronic health effects. DDT has been detected in breast milk, raising serious concerns about infant health.

## 6. Dicofol

Dicofol is an organochlorine pesticide comprising two isomers: p,p'-dicofol and o,p'-dicofol. The technical product (95% pure) is a brown viscous oil and is composed of 80-85% p,p'-dicofol and 15-20% o,p'-dicofol with up to 18 reported impurities.

CAS Nos: 115-32-2 10606-46-9

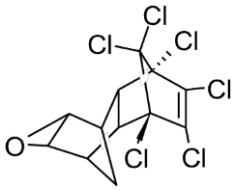
Structures:  

**Use -** Dicofol is an organochlorine miticidal pesticide that has been used in agriculture to control mites on a variety of field crops, fruits, vegetables, ornamentals, cotton, and tea. It was also used as an acaricide for cotton, citrus and apple crops.

**Adverse Effects -** Similar to DDT, dicofol is a toxic concentrated formulation found in the environment and humans with long persistent and bioaccumulative properties. Prolonged or repeated exposure to dicofol can cause skin irritation and hyperstimulation of nerve transmissions along nerve axons. Dicofol is highly toxic in fish, aquatic invertebrates, algae and in birds is tied to eggshell thinning and reduced fertility.

## 7. Dieldrin

CAS No: 60-57-1

Structure: 

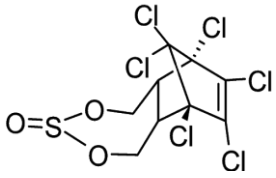

**Use -** Used principally to control termites and textile pests, dieldrin has also been used to control insect-borne diseases and insects living in agricultural soils.

**Adverse Effects -** Dieldrin is highly toxic to fish and other aquatic animals, particularly frogs, whose embryos can develop spinal deformities after exposure to low levels. Dieldrin residues have been found in air, water, soil, fish, birds, and mammals, including humans. Food represents the primary source of exposure to the general population. For example, dieldrin was the second most common pesticide detected in a US survey of pasteurized milk.

## 8. Endosulfan

Endosulfan occurs as two isomers: alpha- and beta-endosulfan. They are both biologically active. Technical endosulfan is a mixture of the two isomers along with small amounts of impurities.

CAS No: 115-29-7 (Technical endosulfan)

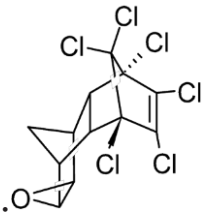



**Use and production -** According to the risk management evaluation on endosulfan, adopted by the POPRC, endosulfan is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy. The use of endosulfan is banned or will be phased out in 60 countries that, together, account for 45 per cent of current global use.

**Adverse Effects -** Endosulfan is toxic to humans and has been shown to have adverse effects on a wide range of aquatic and terrestrial organisms. Exposure to endosulfan has been linked to congenital physical disorders, mental retardations and deaths in farm workers and villagers in developing countries in Africa, Asia and Latin America. Endosulfan sulfate shows toxicity similar to that of endosulfan.

### 9. Endrin

CAS No: 72-20-8

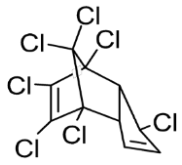
Structure: 


**Use -** This insecticide is sprayed on the leaves of crops such as cotton and grains. It is also used to control rodents such as mice and voles.

**Adverse Effects -** Endrin is highly toxic to fish. When exposed to high levels of endrin in the water, sheepshead minnows hatched early and died by the ninth day of their exposure. The primary route of exposure for the general human population is through food, although current dietary intake estimates are below the limits deemed safe by world health authorities.

### 10.Heptachlor

CAS No: 68961-31-9

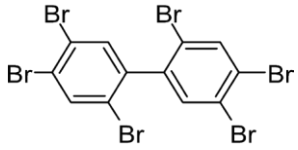
Structure: 


**Use -** Primarily used to kill soil insects and termites, heptachlor has also been used more widely to kill cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes.

**Adverse Effects -** It is believed to be responsible for the decline of several wild bird populations, including Canadian geese and American kestrels in the Columbia River basin in the US. The geese died after eating seeds treated with levels of heptachlor lower than the usage levels recommended by the manufacturer, indicating that even responsible use of heptachlor may kill wildlife. Laboratory tests have also shown high doses of heptachlor to be fatal to mink, rats, and rabbits, with lower doses causing adverse behavioural changes and reduced reproductive success. Heptachlor is classified as a possible human carcinogen. Food is the major source of exposure for humans, and residues have been detected in the blood of cattle from the US and from Australia.

## 11.Hexabromobiphenyl

CAS No: 36355-01-8

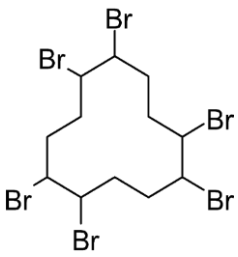
Structure: 


**Use and production -** Hexabromobiphenyl is an industrial chemical that has been used as a flame retardant, mainly in the 1970s. According to available information, hexabromobiphenyl is no longer produced or used in most countries.

**Adverse Effects -** Hexabromobiphenyl is classified as a possible human carcinogen and has other chronic toxic effects.

## 12.Hexabromocyclododecane (HBCD)

CAS No: 3194-55-6




**Use and production -** HBCD is used as a flame retardant additive, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. The main uses of HBCD globally are in expanded and extruded polystyrene foam insulation while the use in textile applications and electric and electronic appliances is smaller. The production of hexabromocyclododecane is a batch process. Elemental bromine is added to cyclododecatriene at 20 to 70 °C in the presence of a solvent in a closed system.

**Adverse Effects -** Though information on the human toxicity of HBCD is to a great extent lacking, vulnerable groups could be at risk, particularly to the observed neuroendocrine and developmental toxicity of HBCD.

## 13.Hexabromodiphenyl ether & heptabromodiphenyl ether

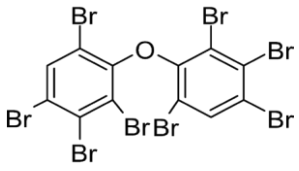
Hexabromodiphenyl ether and heptabromodiphenyl ether are the main components of commercial **octabromodiphenyl ether:**

CAS No: 68631-49-2

CAS No: 207122-15-4

CAS No: 446255-22-7

CAS No: 207122-16-5

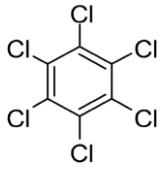
Structure: 


**Use -** Additive flame retardant (BDE) in ABS thermoplastics, PUR foam, coatings & lacquers. Imported consumer products – housings for electronic equipment and household appliances, auto upholstery.

Phased out ca. 2005 Parties are still registered for specific exemptions for use; expiry dates unknown.

## 14.Hexachlorobenzene

CAS No: 118-74-1

Structure: 

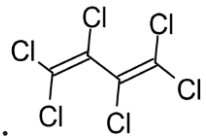

**Use –** First introduced in 1945 to treat seeds, HCB kills fungi that affect food crops. It was widely used to control wheat bunt. It is also a by-product of the manufacture of certain industrial chemicals and exists as an impurity in several pesticide formulations.

**Adverse Effects –** When people in eastern Turkey ate HCB-treated seed grain between 1954 and 1959, they developed a variety of symptoms, including photosensitive skin lesions, colic, and debilitation; several thousand developed a metabolic disorder called porphyria turcica, and 14% died. Mothers also passed HCB to their infants through the placenta and through breast milk. In high doses, HCB is lethal to some animals and, at lower levels, adversely affects their reproductive success. HCB has been found in food of all types. A study of Spanish meat found HCB present in all samples.

### 15.Hexachlorobutadiene (HCBD)

This chemical is a halogenated aliphatic compound, mainly created as a by-product in the manufacture of chlorinated aliphatic compounds.

CAS No: 87-68-3

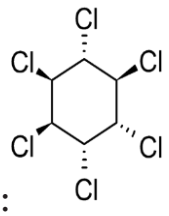
Structure: 

**Use -** Most commonly used as a solvent for other chlorine-containing compounds.

**Production -** Hexachlorobutadiene occurs as a by-product during the chlorinolysis of butane derivatives in the production of both carbon tetrachloride and tetrachloroethene. These two commodities are manufactured on such a large scale, that enough HCBD can generally be obtained to meet the industrial demand.

### 16.Alpha hexachlorocyclohexane (α-HCH)

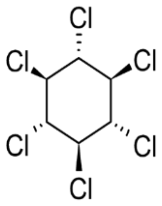
CAS No: 319-84-6

Structure: 

**Use and production -** Although the intentional use of alpha-HCH as an insecticide was phased out years ago, this chemical is still produced as an unintentional by-product of lindane. For each tonne of lindane produced, around 6-10 tonnes of the other isomers including alpha- and beta- HCH are created.

### 17.Beta hexachlorocyclohexane (β-HCH)

CAS No: 319-85-7

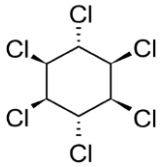
Structure: 

**Use and production** - *(Same as alpha-HCH)*

### 18.Lindane (γ-HCH)

Lindane is the common name for the gamma isomer of hexachlorocyclohexane (HCH). Technical HCH is an isomeric mixture that contains mainly five forms, namely alpha-, beta-, gamma-, delta- and epsilon-HCH.

CAS No: 58-89-9



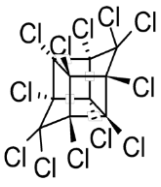

**Use and production -** Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ectoparasites in both veterinary and human applications. The production of lindane has decreased rapidly in the last few years and only a few countries are still known to produce lindane.

*Phased out in the 1990s*

*Specific exemptions have expired*

### 19.Mirex

CAS No: 2385-85-5

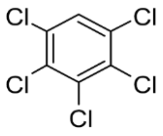
Structure: 


**Use -** This insecticide is used mainly to combat fire ants, and it has been used against other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods.

**Adverse Effects -** Direct exposure to mirex does not appear to cause injury to humans, but studies on laboratory animals have caused it to be classified as a possible human carcinogen. In studies, mirex proved toxic to several plant species and to fish and crustaceans. The main route of human exposure to mirex is through food, particularly meat, fish, and wild game.

## 20.Pentachlorobenzene (PeCB)

CAS No: 608-93-5

Structure: 


**Use and production -** PeCB was used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. previously for the production of quintozene. PeCB might still be used as an intermediate. PeCB is also produced unintentionally during combustion, thermal and industrial processes. It also presents as impurities in products such as solvents or pesticides.

Not traded or intentionally produced by 2006

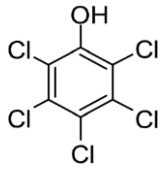
## 21.Pentachlorophenol (PCP)

PCP can be found in two forms: PCP itself or as the sodium salt of PCP, which dissolves easily in water.

CAS No: 87-86-5

No: 131-52-2 (sodium pentachlorophenate) No: 27735-64-4 (as monohydrate)

No: 3772-94-9 (pentachlorophenyl laurate) No: 1825-21-4 (pentachloroanisole)

Structure: 


**Use -** PCP has been used as a herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Some applications were in agricultural seeds, leather, wood preservation, cooling tower water, rope and paper mill systems. Its use has significantly declined due to the high toxicity of PCP and its slow biodegradation.

**Production -** First produced in the 1930s, it is marketed under many trade names. The main contaminants include other polychlorinated phenols, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans.

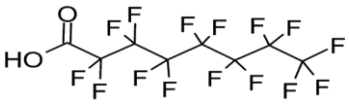
## 22.Perfluorooctanoic acid (PFOA)

Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds mean the following:

i. Perfluorooctanoic acid (PFOA; CAS No. 335-67-1), including any of its branched isomers;
ii. Its salts;
iii. PFOA-related compounds which, for the purposes of the Convention, are any substances that degrade to PFOA, including any substances (including salts and polymers) having a linear or branched perfluoroheptyl group with the moiety (C7F15)C as one of the structural elements.

CAS No: 335-67-1

Structure:



**Use and production -** PFOA, its salts and PFOA-related compounds are used widely in the production of fluoroelastomers and fluoropolymers, for the production of non-stick kitchenware, and food processing equipment. PFOA-related compounds, including side-chain fluorinated polymers, are used as surfactants and surface treatment agents in textiles, paper and paints, and firefighting foams. PFOA has been detected in industrial waste, stain-resistant carpets, carpet cleaning liquids, house dust, microwave popcorn bags, water, food, and Teflon. The unintentional formation of PFOA is created from inadequate incineration of fluoropolymers from municipal solid waste incineration with inappropriate incineration or open burning facilities at moderate temperatures.

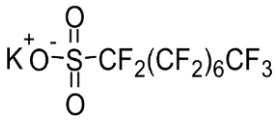
**Adverse Effects -** PFOA exhibits adverse effects for both terrestrial and aquatic species. Major health issues in humans including kidney cancer, testicular cancer, thyroid disease, pregnancy-induced hypertension, and high cholesterol have been linked to PFOA.

## 23. Perfluorooctane sulfonic acid (PFOS), its salts, & perfluorooctane sulfonyl fluoride

PFOS is a fully fluorinated anion, which is commonly used as a salt or incorporated into larger polymers. PFOS and its closely related compounds, which may contain PFOS impurities or substances that can result in PFOS, are members of the large family of perfluoroalkyl sulfonate substances.

Perfluorooctane sulfonic acid CAS No: 1763-23-1

Perfluorooctane sulfonyl fluoride (Salts) CAS No: 307-35-7

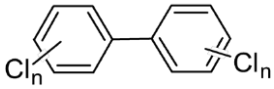
Structure: 

**Use and production -** PFOS is both intentionally produced and an unintended degradation product of related anthropogenic chemicals. The current intentional use of PFOS is widespread and includes: electric and electronic parts, fire-fighting foam, photo imaging, hydraulic fluids and textiles. PFOS is still produced in several countries.

**Adverse Effects -** PFOS has substantial bioaccumulating and biomagnifying properties, although it does not follow the classic pattern of other POPs by partitioning into fatty tissues but instead binds to proteins in the blood and the liver. It has the capacity to undergo long-range transport and also fulfils the toxicity criteria of the Stockholm Convention.

### 24. Polychlorinated biphenyls (PCBs)

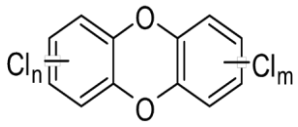
CAS No: 1336-36-3

General Structure: 

**Use -** These compounds are used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, and plastics. Of the 209 different types of PCBs, 13 exhibit dioxin-like toxicity. Their persistence in the environment corresponds to the degree of chlorination, and half-life canary from 10 days to one-and-a-half years.

**Adverse Effects -** PCBs are toxic to fish, killing them at higher doses and causing spawning failures at lower doses. Research also links PCBs to reproductive failure and suppression of the immune system in various wild animals, such as seals and mink. Consumption of PCB-contaminated rice oil in Japan in 1968 and Taiwan in 1979 caused pigmentation of nails and mucous membranes and swelling of the eyelids, along with fatigue, nausea, and vomiting. Due to the persistence of PCBs in their mothers' bodies, children born up to seven years after the Taiwan incident showed developmental delays and behavioural problems. Similarly, children of mothers who ate large amounts of contaminated fish from Lake Michigan showed poorer short-term memory function. PCBs also suppress the human immune system and are listed as probable human carcinogens.

## 25. Polychlorinated dibenzodioxins (PCDDs)

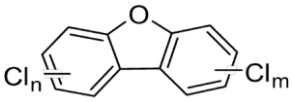



General Structure:

**Use –** These chemicals are produced unintentionally due to incomplete combustion, as well as during the manufacture of pesticides and other chlorinated substances. They are emitted mostly from the burning of hospital waste, municipal waste, and hazardous waste, and also from automobile emissions, peat, coal, and wood. There are 75 different dioxins, of which seven are considered to be of concern.

**Adverse Effects –** Dioxins have been associated with a number of adverse effects in humans, including immune and enzyme disorders and chloracne, and they are classified as possible human carcinogens. Laboratory animals given dioxins suffered a variety of effects, including an increase in birth defects and stillbirths. Fish exposed to these substances died shortly after the exposure ended. Food (particularly from animals) is the major source of exposure for humans.

## 26. Polychlorinated dibenzofurans (PCDFs)




General Structure:

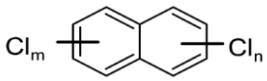
**Use -** These compounds are produced unintentionally from many of the same processes that produce dioxins, and also during the production of PCBs. They have been detected in emissions from waste incinerators and automobiles.

**Adverse Effects -** Furans are structurally similar to dioxins and share many of their toxic effects. There are 135 different types, and their toxicity varies. Furans are classified as possible human carcinogens. Food, particularly animal products, is the major source of exposure for humans. Furans have also been detected in breastfed infants.

## 27. Polychlorinated naphthalenes (PCNs)

Commercial PCNs are mixtures of up to 75 chlorinated naphthalene congeners plus by-products and are often described by the total fraction of chlorine.

CAS No: 70776-03-3 (chlorinated naphthalenes)




General Structure:

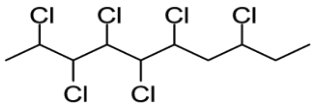
**Use -** PCNs make effective insulating coatings for electrical wires. Others have been used as wood preservatives, as rubber and plastic additives, for capacitor dielectrics and in lubricants.

**Production -** Made by chemically reacting chlorine with naphthalene, a soft, pungent solid made from coal or petroleum and often used for mothproofing. PCNs started to be produced for high-volume uses around 1910 in both Europe and the United States. To date, intentional production of PCN is assumed to have ended. PCN is unintentionally generated during high-temperature industrial processes in the presence of chlorine.

### 28. Short-chain chlorinated paraffins (SCCPs)

These are short-chain chlorinated paraffins, that is, 10-13 carbons with >48% (w/w) chlorination.

CAS No: 85535-84-8




Representative Structure:

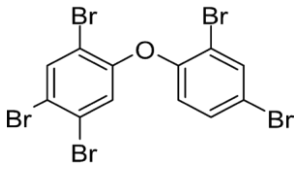
**Use and Production -** SCCPs can be used as a plasticizer in rubber, paints, adhesives, flame retardants for plastics as well as an extreme pressure lubricant in metalworking fluids. Chlorinated paraffins are produced by chlorination of straight-chained paraffin fractions.

### 29. Tetrabromodiphenyl ether & pentabromodiphenyl ether

Tetrabromodiphenyl ether and pentabromodiphenyl ether are the main components of commercial **pentabromodiphenyl ether**.

CAS No: 5436-43-1

CAS No: 60348-60-9




Structure:

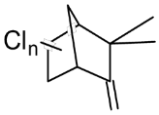
**Use -** Polybromodiphenyl ethers and Polybromodiphenyl ether congeners including tetraBDE, pentaBDE, hexaBDE, and heptaBDE inhibit or suppress combustion in organic materials and therefore are used as additive flame retardants.

**Adverse Effects -** These chemicals have been detected in humans in all regions. There is evidence of its potential for toxic effects on wildlife, including mammals.

Ceased in 2007

### 30. Toxaphene

CAS No: 8001-35- 2

General Structure: 


**Use -** This insecticide was used on cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock. Toxaphene was the most widely used pesticide in the US in 1975.

**Adverse Effects -** For humans, the most likely source of toxaphene exposure is food. While the toxicity to humans of direct exposure is not high, toxaphene has been listed as a possible human carcinogen due to its effects on laboratory animals. It is highly toxic to fish; brook trout exposed to toxaphene for 90 days experienced a 46% reduction in weight and reduced egg viability, and long-term exposure to levels of 0.5 micrograms per litre of water reduced egg viability to zero.

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