

Stockholm Convention -Toolkit Project

**A REPORT ON QUANTITATIVE INVENTORY ASSESS-
MENT OF PNG CUSTOMS IMPORT TRADE DATA-
2010 -2019**

**A PARTIAL FULFILMENT OF INVENTORY ASSESSMENT ON POPs IN PA-
PUA NEW GUINEA**

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List of Acronyms

AFFF	Aqueous Firefighting Foam
ASYCUDA	Automated Systems for Customs Data
CEPA	Conservation and Environment Protection Authority
c-octaBDE	Commercial-octabromodiphenyl ether
c-penatBDE	Commercial-pentabromodiphenyl ether
CRT	Cathode Ray Tube
DDT	Dichlorodiphenyl trichloroethane
decaBDE	Decabromodiphenyl ether
EEE	Electrical and Electronic Equipment
EPS	Expanded Polystyrene
HBCD	Hexabromocyclododecane
HIPS	High Intensity Polystyrene
HS	Harmonized Systems
ICT	Information and Communications Technology
Mt	Mega tonne
MVIL	Motor Vehicle Insurance Limited
NIP	National Implementation Plan
PBDEs	Polybrominated diphenyl ether
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-para dioxins
PCDF	Polychlorinated dibenzo furans
PCNs	Polychlorinated naphthalenes
PCPs	Pentachloro phenols
PFOS	Perfluorooctane sulphonic acid
PNG	Papua New Guinea
POPs	Persistent Organic Pollutants
PUR	Polyurethane
SC	Stockholm Convention
SCCPs	Short-chain chlorinated paraffins
SDS	Safety Data Sheet
t	tonne (metric)
UNEP	United Nations Environment Programme
uPOPs	Unintentional Persistent Organic Pollutants
WEEE	Waste Electrical and Electronic Equipment
XPS	Extruded Polystyrene

Executive Summary

The gap analysis comparisons performed on both the 2006 NIP report and the current 2019 NIP update report with Article 15 reporting requirements, revealed the enormity of the existing data and information gaps required by the party. PNG lags the 4th cycle Article 15 reporting, foresees to meet the 5th cycle reporting. Despite lack of progress in development of the inventory assessment of POPs, the listings of new POPs (16 new) poses an additional challenge.

Data collections procedures presented were disbursed during a national workshop held in August, 2020 followed by distribution of questionnaire inventory survey which proved unsuccessful and was stalled. Data and information gaps on quantities of POPs on usage, sales, stockpiles, waste stockpiles and the identification of contaminated sites remain incomplete.

PNG Customs Services import trade data was extracted from their database¹, where 309,376 line items were assessed for POPs quantities derived from the 337 HS codes listed, that contained or consist of POPs chemicals, articles and or products. This assessment was for the period 2010 to 2019 is presented in this report.

During past 10 years, an annual average² of 6.371 tonnes (t) of POPs, and a total of 63.706 t were imported into the country. The major contributors of POPs quantities were mainly Polybrominated diphenyl ether (31.497 t) and the short chain chlorinated paraffin's (26.259 t). The product that featured prominently was intumescent paint (11.189 t of decaBDE) and the waterproofing paints (26.269 t of SCCPs). Other flame retardants products that contained or consisted of hexabromocyclododecane (4.816 t of HBCD) where mainly from the use of high impact poly styrene (HIPS) in construction projects. Others POPs, such as PFOS (0.434 t), PCNs (0.240 t), PCBs (0.000³ t) and POP – Pesticides (0.450 t) were ascertained in small quantities.

Further analysis of the import trade data revealed, China (9.897 t), Malaysia (3.548 t), Australia (3.201 t), Singapore (2.095 t) and Japan (2.052 t) were the origins of POPs articles and products. PNG as the party to the convention recorded 40.078 t of POPs, probably allocated as default source of origin.

Annual imports of POPs showed an increase imports of POPs articles and products mainly attributed to second hand vehicle trade as shown by high PBDEs values of 6.734 t and 5.975 t for years 2018 and 2019 respectively. This average of both years surpassed the annual average of POPs quantity imports.

Quantification assessment of the customs import trade data were performed using comprehensive UN environment programmed guidance documents for POP-PBDEs, HBCD, PFOS/PFOSF, SCCPs, PCNs, PCBs and POP-Pesticides. Prior this work, the activities achieved where the gap analysis reporting, conducted a national workshop and training, developed questionnaire sets for Tier II assessment approach and developed a database sorting and evaluation process. The accomplishment of the latter has resulted in deriving this report.

¹ Automated Systems for Customs Data (ASYCUDA)

² Sum of annual average of [PBDEs, HBCD, PFOS, SCCPs, PCNs, PCBs and Pesticides]

³ 14 mg of PCBs

1. Introduction

Article 7 and 15 requires Parties to provide regular updates on progress in implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) through submission of National Reports every four years or inadvertently update the National Implementation Plan (NIP) for POPs whenever required.

Papua New Guinea as a party to the Stockholm Convention since its inception in 2006 had submitted an initial NIP in 2013 and had recently reviewed and submitted the NIP in 2019 including the assessment of newly (16) listed POPs.

The recent gap analysis report had identified the overlaps and gaps required by Article 15 reporting. Similarly, the data and information ascertained for the NIP updates correlated and therefore were pursued comparably to meet the common obligations. This inventory assessment had provided for development of the integrated electronic (IE) reporting system as further stipulated in the SC Toolkit project.

The SC Toolkit Project was sanctioned in June, 2020, then convened a National Coordination Committee meeting (June 30, 2020). A comprehensive national workshop was held at Lae, Morobe Province in August, 2020 where a short training was held on the data collection processes and procedures based on UN environment programme guidance documents on POPs. The data and information collection processes were then performed by disbursing inventory assessment questionnaires. A total of 159 usual established companies and organizations were identified and distributed 759 questionnaire sets by email based on their economic activities. Inopportunately, none of the questionnaires were successfully returned to achieve the anticipated data and information gaps on usage, sales, stockpiles, waste stockpiles and identification of contaminated sites for POPs. Earlier in August, 2020, a total of 337 listed customs harmonized system (HS) codes were provided to PNG Customs Services to extract data and information on POPs consisting or containing chemicals, articles and products. A total of 309,376 line items (spreadsheet) was produced from ASYCUDA database identified based on perceived HS code allocations.

The data and information assessment and analysis was based only on the import trade data on chemicals, articles and products that contain or consist of POPs for the period 2010 to 2019. The groups of assessed were the commercial octa-bromodiphenyl ether (c-octaBDEs), deca-bromodiphenylether (decaBDE), commercial-penta-bromodiphenyl ether (c-pentaBDEs), Polybrominated diphenyl ethers (PBDEs), Hexabromocyclododecane (HBCD), Perfluorooctane sulfonic acid (PFOS) /Perfluorooctane sulfonyl fluoride (PFOSF) and related salts, Pentachloronaphthalenes (PCNs), Polychlorinated-biphenyls (PCBs), Short chain chlorinated paraffin (SCCPs) and the POPs- Pesticides. A notable absence of initial POP- chemicals dubbed 'dirty dozen', pentachlorophenols (PCPs) and hexachlorobutadiene (HCBD) were excluded in this assessment plan.

This report further evaluated and assessed the customs trade database in its entirety and ensured all possible sources of POPs chemicals, articles and products were identified accordingly and quantitatively inventoried.

1.2 Objectives

The main objectives of the analysis were to identify and compile:

- quantitative data requested to be included within the Article 15 reporting;
- quantitative data and information requested to be included within other reports to be prepared under the Stockholm Convention (POP- Pesticides and DDT, POP-PBDEs, HBCD, PFOS/PFOSE, SCCPs, PCNs, PCBs and uPOPs);
- the data and information, both qualitative and quantitative, generated during the NIP development and/or update;
- conclusions and recommendations to correlate the processes of reporting under Article 15 and other reporting obligations under the Stockholm Convention with the process of developing and updating the NIP.

A notable outcome of the project will eventually full fill the requirements of Article 15 reporting and also development of integrated electronic (IE) reporting using the SC online system (UNEP, 2019) and the development of the NIP reporting module which should replace the current NIP update/review processes.

1.3 Project timeline and deliverables

The progress work on the SC Toolkit project has highlighted various levels of issues associated with the management and the schedules. Data collection was the main focus and desire to deliver a statistically acceptable data and information to meet the reporting requirements remains a challenge. Historically, the party has missed up to 4th cycle of Article 15 reporting obligations and the prescribed 5th cycle shown in the timeline is a far-flung from being a plan.

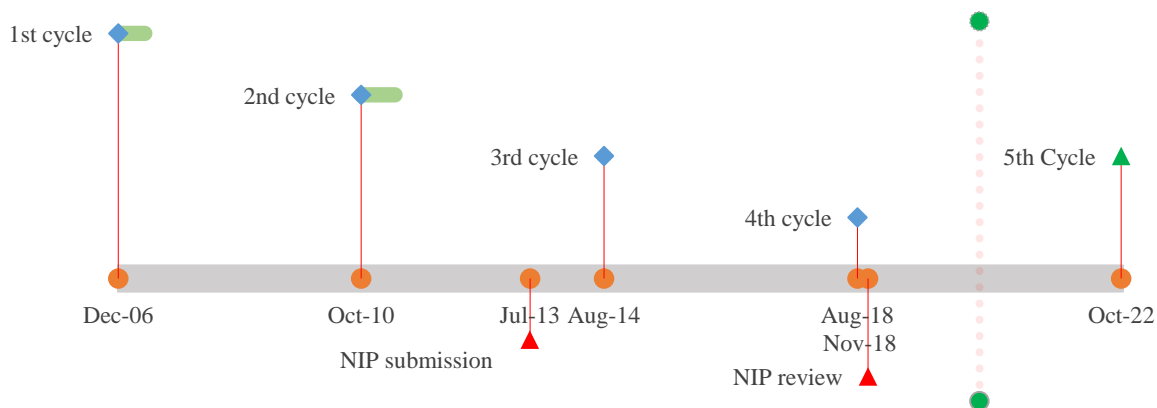


Figure 1 Article 15 reporting cycle and NIP submittal timeline

Since the project inception, several delays were experienced thus proving difficult to meet the project timeline of four-month duration. Despite the setbacks, the following project deliverables were accomplished as listed.

- Delivered the Gap Analysis Report (Rivu, 2020) on Article 15 reporting requirements in comparison with NIP update reporting;
- Conducted a national awareness workshop and training on Data Collection on POPs chemicals;

- Compiled 337 HS codes likely to contain or consist POPs chemicals to PNG Customs Services (PNG Customs Services, 2012);
- Disbursement of the questionnaire sets for all the listed POPs including the uPOPs to potential 150 entities identified to carry chemicals, articles and products that contain or consist of POPs;
- Data evaluation and assessment of the PNG Customs import trade data generated from the HS code listings; and currently this report;
- The quantitative assessment of POPs in PNG determined from 2010 to 2019 import trade data.

2 Methodology

The UNEP guidance documents provided the study guide to development the inventory assessment and the data collection procedures and process. One of the main information sources used was the power point presentations (Paun, 2020) developed by UNEP. The following guidance documents were consulted at various stages to develop the inventory assessment questionnaire and the quantification of POPs as listed:

- *Guidance for inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Organic Pollutants – Revised 2017*
- *Preliminary draft guidance on preparing inventories of decabromodiphenyl ether – April 2019*
- *Guidance for the inventory of Hexabromocyclododecane (HBCD)- April 2019*
- *Guidance on preparing inventories of perfluorooctane sulfonic acid (PFOS) and related compounds listed under Stockholm Convention on Persistent Organic Pollutants – January 2017*
- *Detailed Guidance on preparing inventories of short-chain chlorinated paraffin (SCCPs)- Draft 2019*
- *Guidance on preparing inventories of polychlorinated naphthalene (PCNs) – April 2019*
- *Manual for National Reports under Article 15 of the Stockholm Convention (Fourth reporting cycle) – March 2019*

Based on the inventory assessment requirements, the following listed assessment was pursued due presence of the data and information determined from customs import trade data.

- Assessment of POPs pesticides (Annex A, Part I)
- Assessment of POPs-PBDEs
- Assessment of HBCD
- Assessment of PFOS, its salts and PFOSF
- Assessment of SCCPs
- Assessment of PCNs
- Assessment of PCBs (Annex A, Part II)
- Assessment of Unintentional POPs (uPOPs)

2.1 Questionnaire disbursement

A set of questionnaires were prepared according to UN environment programme guidance documents, customized to PNG requirements and economic basis. The type of questions was presented to obtain data on quantitative data, waste management information and impart education and awareness on POPs and its impact on the environment. The following suit of questionnaires were distributed using electronic email systems.

- Questionnaire – POPs Pesticides and DDT (30 questions, 2 quantitative tables, 8 pages)
- Questionnaire – PCBs (20 questions, 1 quantitative tables, 5 pages)
- Questionnaire –PBDEs (22 questions, 1 quantitative table, 5 pages)
- Questionnaire- PFOS (30 questions, 1 quantitative table, 6 pages)
- Questionnaire- HBCD (8 major questions, 6 pages)
- Questionnaire-PCNs (40 questions,3 pages)
- Questionnaire- SCCPs (13 questions 19 pages)
- Questionnaire- uPOPs (7 groups of quantitative tables, 13 pages)

2.2 Quantification of POPs

The calculations were performed according to UNEP guidelines based on various data collection guidelines presented in a workshop in 2020. Most of the concentrations factors (f concentrations) were extracted from contents of the presentation documents.

2.2.1 POP – Polybrominated diphenyl ethers (PBDEs),

The POPs-PBDEs was pursued by determining quantities of c-octaBDE, decaBDE and c-pentaBDEs based on fixed polymer fractions of articles and products categorized as electronic and electric equipment (EEE) and the information and communication technology (ICT) sectors.

Basic calculation equation (UNEP, 2017, p. 37) was based on the polymer fraction(*k*), the mean concentration (%) of the either c-octaBDE or decaBDE and or c-pentaBDEs (*i*) and the quantity M EEE (*j*).

$$M_{PBDE(i)} = M_{EEE(j)} * f_{Polymer(k)} * C_{PBDE(i); Polymer(k)}$$

Equation 1

Other products and articles that does not contain polymer fractions were calculated using only the concentration factors and quantities (kg). Table 7 provides a list of mean concentrations and polymer fractions and mean weights of articles and products that consist or contain PBDEs. The perceived changes in calculation of decaBDE and c-pentaBDEs were noted as footnotes of Table 7 listed under Appendix I

2.2.2 Hexabromocyclododecane (HBCD)

Generally, the uses of HBCD articles and products were predominantly from foam products of polyurethane (PUR), polypropylene (PP) and polystyrene (EPS, XPS, HIPS) base used in construction activities mainly in building and construction sites. The calculation involves the quantities of articles and products containing HBCD multiplied by the concentration of HBCD in the fraction of the foam.

Only both the expandable polystyrene (EPS) and high impact polystyrene (HIPS) were dominant imports. The HBCD concentrations in both EPS (0.75%) and HIPS (4.00%) were the mean values used in Equation 2 (UNEP, 2019) below.

$$\text{Equation 2} \\ TQ\ HBCD\ (t) = TQ\ Imported\ (t) \times C\ HBCD\ (\%)$$

2.2.3 Perfluorooctane sulfonic acid (PFOS) /Perfluorooctane sulfonyl fluoride (PFOSF) and its salts

The quantification of PFOS/PFOSF and related chemicals was similar to that of HBCD. PFOS related chemicals were mainly applied in firefighting as aqueous firefighting foam (AFFF) or as an insecticide to prevent leaf eating ant as required for exemptions under SC.

Based on the required exemptions, the search for import of PFOS/PFOSF related chemicals and articles were limited and calculated using Equation 3.

$$\text{Equation 3} \\ TQ\ PFOS\ (t) = TQ\ Imported\ (t) \times C\ PFOS\ (\%)$$

The concentration factors for PFOS/PFOSF (C PFOS (%)) were that of additives (AFFF, 3.25%), coatings (0.25% - especially in impregnation of paper and packaging, synthetic carpets, leather, textiles and back coating upholstery), lubricants especially aviation lube (0.75%) and tonner and printing inks (0.010%) (Paun, 2020).

2.2.4 Short chain chlorinated paraffin (SCCPs)

The use of SCCPs were mostly found in paints, rubber and textile products and articles as some common items. Various types of SCCPs concentration ranges (Paun, 2020) were specifically applied for intumescent paints for structural steel (25%), plastisol screen printing inks and textiles (17.5%), intumescent paint for ferrous substrate (7.5%), chemical and water resistant coatings (12.5%), road marking paints (6.5%), zinc rich epoxy paints (3.5%) and chlorinated rubber primers and top coats (3.0%). Other applications include the use of pipe seals (4.0%), fire resistant rubber products (10%), and lubricants of various types (30.5%) in rails, ships, automotive, industrial machinery, power generation, etc. The basic quantification formula (UNEP, 2019) was used as shown in Equation 4.

$$\text{Equation 4} \\ TQ\ SCCPs\ (t) = TQ\ Imported\ (t) \times C\ SCCPs\ (\%)$$

2.2.5 Polychlorinated biphenyls (PCBs)

Quantification of PCBs diverge from other POPs chemicals. PCBs are mainly used in transformers and large capacitors as closed applications in power generation. Imports of transformer oils remains unclear as various trade names of lubricants requires clearances for PCB contents. Uncertainty in quantifying PCBs used in open application such as aerosol additives exist, yet explored.

In essence, the much needed work required for quantification of PCBs in the country is focussed on the use of PCB contaminated oil and the transformer equipment.

2.2.6 Polychlorinated naphthalene's (PCNs)

As similar to PCBs, both PCNs were assessed in an integrative manner and the concentration factors are as listed below. Same quantity of articles and products were used in calculating the content of either of PCNs and PCBs.

2.2.7 POPs – Pesticides

Determining a quantity of POPs – Pesticides is somewhat skewed towards reporting its recorded value. However, this can be corrected to according to presences of POPs as a component of the ingredients. This level of information is provided in safety data sheets (SDS) of a pesticides or chemical substances or alternatively the product specifications.

The absence of listed POPs – Pesticides in this customs import trade database indicates lack of clarity based on information available. Several hints using the trade names or product names indicated lack of presence of listed original POPs-Pesticides known as “dirty dozen”.

3 Results

The following results reported herein were based on the inventory assessment plan. Table 1 presents quantities of annual import trade of POPs chemicals as PBDEs, HBCD, PFOS, PCNs, PCBs and POP-Pesticides for the period 2010 to 2019. Table 2 provides detailed assessment of chemicals, articles and products that contain or consist of POPs imported during this period.

3.1 Quantitative assessment of POPs based on annual import trade

Annual trends of imported POPs quantities revealed and partially relates to economic and developmental activities in the country. On the flip side, the use of pesticides may indicate pest issues that relate to agricultural developments. Indications below shows a steady growth since 2012, then eventually increased in 2017 to 2019 where a total of 63.706 t was obtained. The assessment also shows both PBDEs and SCCPs to be noticeable. The data gaps shown also depicts the impact of imposed bans on POPs chemicals listed in Annex A and Annex B of the convention.

Table 1 Quantities of annual import trends of POPs quantities (t), items (millions), derived weight (Mt)

Year	n (10 ⁶)	Qty (Mt)	PBDEs (t)	HBCD (t)	PFOS (t)	SCCPs (t)	PCNs (t)	PCBs (t)	Pesti- cides (t)	Total POPs (t)	% POPs
2010	.503	6.853	1.529	.020		2.261	-	.000		3.810	5.98%
2011	.673	7.846	.909	.099		.338	.000	.000		1.346	2.11%
2012	1.167	11.486	2.123	.034	.001	1.756	.000			3.913	6.14%
2013	.994	11.211	1.989	.888	.000	.730	.025	.000		3.633	5.70%
2014	1.468	11.781	1.645	.151	.000	1.606	.169			3.571	5.61%
2015	1.283	15.365	1.918	.916	.429	2.321	.046			5.630	8.84%
2016	3.903	33.718	4.344	1.313	.000	4.696				10.353	16.25%
2017	8.219	29.448	4.331	.189	.000	2.121		.036		6.677	10.48%
2018	3.480	38.646	6.734	.904	.000	4.651		.142		12.431	19.51%
2019	1.752	31.459	5.975	.302	.003	5.789		.272		12.341	19.37%
Total	23.444	197.811	31.497	4.816	.434	26.269	.240	.000	.450	63.706	100.00%

In column 2 (n, 10⁶) of the data above, the sum of individual items assessed were in excess of millions indicating the values presented may be too high with respect to the economic developments of the country. Similarly, the quantities of chemicals, articles and products presented (Mt) were either ascertained using recorded weights or derived using estimates of an item.

3.2 Quantitative assessment of POPs containing or consisting chemicals, articles and products (CAPs)

In brief, the Table 2 is arranged according to chemicals, articles and products that consist or contain POPs. An estimate of 25 items were identified and their POPs quantities as presented below. Products such as paints (58.8 %) appeared dominant, where both intumescent and water proofing types, which contained high decaBDE and SCCPs respectively. The other products such as HIPS (7.27%) contained HBCD was mostly used in construction; both electrical equipment (6.34%) and CRT TVs (6.17%) contributed c-octaBDEs.

Furthermore, to fulfil the inventory assessment, the following discussions were pursued to highlight the prominent chemicals, articles and products; their annual import trends and likely sources including the country of origin.

Table 2 Summary of quantified POPs (t) ascertained from the customs import trade data (2010-2019) based on listed chemicals, articles and products

Articles/Products	n(10 ⁶)	Qty (Mt)	c-octaBDE (t)	decaBDE (t)	Ec-pentaBDEs (t)	PBDEs (t)	HBCD (t)	PFOS (t)	SCCPs (t)	PCNs (t)	PCBs (t)	Pesticides (t)	Total POPs (t)	% POPs
paint	-	.334		11.189		11.189			26.269				37.458	58.80%
foam(HIPS)	-	.116				-	4.633						4.633	7.27%
electrical equipment	4.571	112.182	4.039			4.039							4.039	6.34%
CRT TVs	.287	5.158	3.931	-		3.931							3.931	6.17%
cars	3.238			1.248	2.475	3.723							3.723	5.84%
foam(PUR)	-	.030		2.580		2.580							2.580	4.05%
fridge/freezer	2.003	31.679	1.140			1.140							1.140	1.79%
flat panel display/TVs	.931	10.473		.990		.990							.990	1.55%
buses	.182			.073	.901	.974							.974	1.53%
air conditioners	.924	17.092	.615			.615							.615	0.97%
trucks	.489			.196	.391	.587							.587	0.92%
it equipment	3.745	5.746		.543		.543							.543	0.85%
DDT "clofenotane"	-	.000										.450	.450	0.71%
chemical products derivatives	-	.013						.429		-			.429	0.67%
computers	.609	3.651		.345		.345							.345	0.54%
adhesives/sealants	-	.002								.240			.240	0.38%
laptops	1.849	2.044		.193		.193							.193	0.30%
mobile phones	3.532	1.766		.167		.167							.167	0.26%
foam(EPS)	-	.022					.166						.166	0.26%
telephones	.234	1.675		.158		.158							.158	0.25%
electronic equipment	.242	1.421		.134		.134							.134	0.21%
washing machines/dryers	.051	3.331	.120			.120							.120	0.19%
foam(XPS)	-	.001		.021		.021	.017						.038	0.06%
heaters/ventilators	.055	.726	.026			.026							.026	0.04%
radios	.039	.078		.015		.015							.015	0.02%
cameras	.281	.224	.006			.006							.006	0.01%
hydraulic fluids	-	.007						.005					.005	0.01%
irons/pressers	.025	.038	.001			.001							.001	0.00%
lubricants	-	.000						.000			.000		.000	0.00%
Total	23.287	197.811	9.878	17.851	3.767	31.497	4.816	17.851	3.767	17.851	3.767	31.497	4.816	100.00%

3.3 POPs Assessment

3.3.1 Assessment of POPs-PBDEs

The detail assessment of PBDE homologues is shown in Table 3. A total of 31,497 t of PBDEs were ascertained from the 21 items listed. The paints were found dominant containing 11,189 t of decaBDE obtained from intumescent paints; as oxides (1,093 t), metal (2,339 t), marine (3,559 t), rust and anti-corrosion (4,197 t). The electrical equipment had contributed electrical cookers/cooktops as major component of 4,039 t as c-octaBDE. The next major contributor was the then CRT TV, now deemed obsolete was due to high loading form c-octaBDE fraction of the polymer (UNEP, 2017, p. 48). The annual import trends are shown in Figure 2.

Table 3 List of major articles and products that contribute to the quantities of POP-PBDEs. PBDEs homologues quantities were calculated for hexaBDE, heptaBDE, tetraBDE and pentaBDE.

Articles/Products	hex-aBDE 11%, (t)	hep-taBDE 43%, (t)	tet-raBDE 33%, (t)	pen-taBDE 58%, (t)	c-oc-taBDE (a),(t)	decaBDE (b), (t)	c-pen-taB-DEs (c), (t)	PBDEs Sum (a,b,c)(t)	% PBDEs
paint						11.189		11.189	35.52%
electrical equipment	.444	1.737			4.039			4.039	12.82%
CRT TVs	.432	1.690			3.931	-		3.931	12.48%
cars	.198	.012	.817	1.435		1.248	2.475	3.723	11.82%
foam(PUR)						2.580		2.580	8.19%
fridge/freezer	.125	.490			1.140			1.140	3.62%
flat panel display/TVs						.990		.990	3.14%
buses	.072	.005	.297	.523		.073	.901	.974	3.09%
air conditioners	.068	.265			.615			.615	1.95%
trucks	.031	.002	.129	.227		.196	.391	.587	1.86%
it equipment						.543		.543	1.72%
computers						.345		.345	1.10%
laptops						.193		.193	0.61%
mobile phones						.167		.167	0.53%
telephones						.158		.158	0.50%
electronic equipment						.134		.134	0.43%
washing machines/dryers	.013	.052			.120			.120	0.38%
heaters/ventilators	.003	.011			.026			.026	0.08%
foam(XPS)						.021		.021	0.07%
radios						.015		.015	0.05%
cameras	.001	.003			.006			.006	0.02%
irons/pressers	.000	.001			.001			.001	0.00%
Total	1.388	4.267	1.243	2.185	9.878	17.851	3.767	31.497	100.00%

Further analysis on c-octaBDE and c-pentaBDE were determined that estimated levels of homologues such as hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether.

Based on Tables 1 (UNEP, 2017, p. 14) of the guidance documents of PBDEs, the following homologue distribution of c-pentaBDE showed tetrabromodiphenyl ether (BDE 47) at 33% and pentabromodiphenyl ether (BDE 99, BDE 100/87) at 58% as major congeners. As for c-octaBDE, Table 2 of guidance document had homologue distribution at 11% for hexabromodiphenyl ether (BDE 153/154) and 43% for heptabromodiphenyl ether (BDE 183/180/171) as major congeners. Using the data from Table 3 above, the quantities of the hexabromodiphenyl ether (1.388 t) heptabromodiphenyl ether

(4.267 t), tetrabromodiphenyl ether (1.243 t) and pentabromodiphenyl ether (2.185 t) were derived respectively.

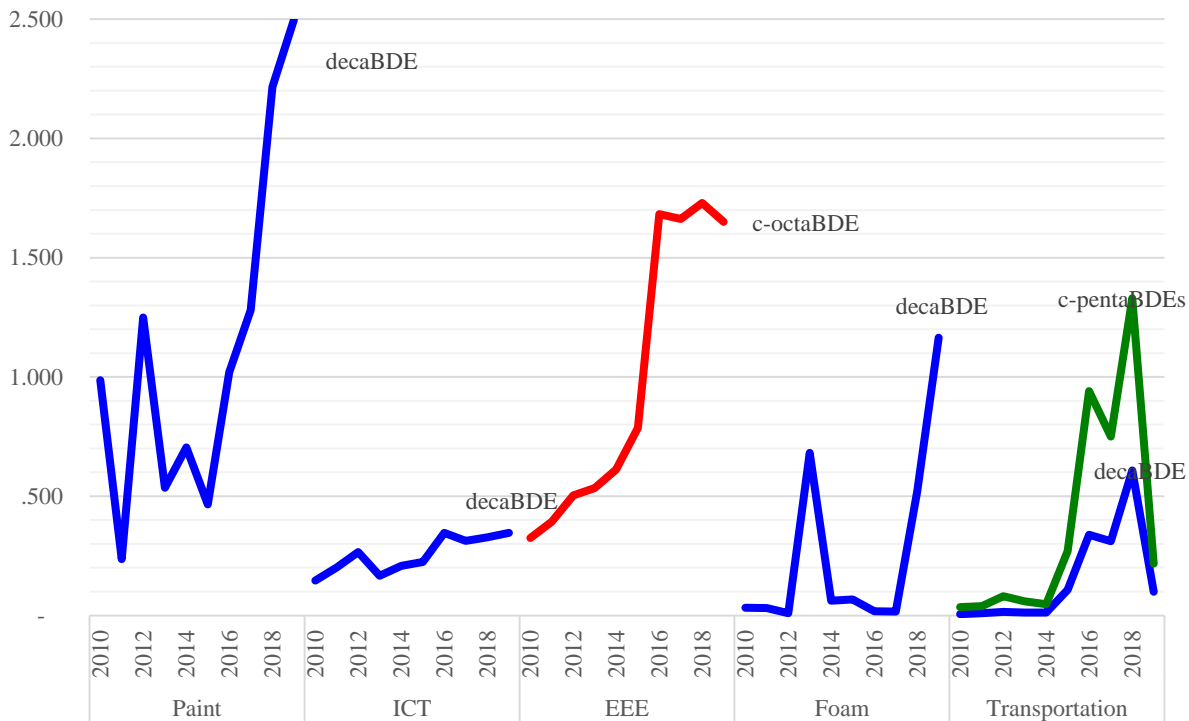


Figure 2 Annual import trends of high % POPs articles and products such as paints (intumescent), ICT equipment, electrical consumer items, foam especially polyurethane and the second hand cars

3.3.2 Assessment of HBCD

Three main products as HIPS (4.633 t), EPS (0.166 t) and XPS (0.017 t) were identified to have contained HBCD according to guidance document (UNEP, 2019). HIPS were predominantly used in building and construction activities. The annual import trend showed high quantities in 2016 (1.313 t), 2015 (0.916 t) and in 2018 (0.904 t) which were attributed to increase in various infrastructure development projects in the country.

Based on imports of raw materials of foam products certain level of manufacturing activity of polyurethane (PUR) foam products in the country. Some of the raw materials used in foam manufacturing were *Lupranate/Caradol*, *Tegostab*, and *Voranate/ Voranol*. The uncertainty that pertains to treatment of these raw materials to have contain or consist HBCD as an additive is unknown.

Additionally, in comparison with NIP reports (CEPA, 2019) on HBCD shown in Table 12 were reportedly high for HIPS (5.864 t) and EPS (6.501) for the period 2006 to 2016 due to application of higher concentration loading. The revised calculations on the same data using the recent mean values showed HIPS at 3.351 t and EPS at 6.965 t.

3.3.3 Assessment of PFOS, its salts and PFOSF

A one of aqueous fire-fighting foams(AFFF) was imported in 2015 with a quantity of 13 t that calculated as 0.429 t of PFOS. An alternative chemical to AFFF listed as Fireade 2000, had 0.380 t was imported.

The entity⁴ that manages airports in the county was the importer. In addition, a noticeable absence of exempted insecticide used for eliminating leaf eating ants showed no records of imports. A small quantity (0.005 t) of PFOS was determined from an aviation hydraulic fluid used in close applications as fire resistant chemicals.

Furthermore, in an isolated reference regarding the following listed chemicals were found to be related to the *sulphonic acid*, a partial component of PFOS salts and related PFOSF. Other chemicals such as *linear alkyl benzene sulphonic acid*, *sodium dodecyl benzene sulphonate* (LABSA) and *methane sulphonic acid* proved disparate to PFOS therefore was not assessed.

3.3.4 Assessment of SCCPs

A total of 26.269 t of SCCPs was ascertained from paints. The paints subcategories considered likely to contain SCCPs as shown in table below mainly dominated by waterproofing and marine paints.

Table 4 Imported paint derivatives likely contain SCCPs

Paint types	SCCPs (t)	% SCCPs
Chlorinated	.481	1.83%
Fire Retardant	.308	1.17%
Intumescent	.000	0.00%
Marine	4.271	16.26%
Road Markers	2.108	8.02%
Metal	2.807	10.69%
Oxide	1.312	4.99%
Anti-Rust	5.037	19.17%
Waterproofing	9.597	36.53%
Zinc Epoxy	.348	1.33%
Total	26.269	100.00%

Other notable sources of SCCPs is the use of pipe seals in drilling activities, mainly used in mining and petroleum sectors, where a significant quantity was imported that required verification. Similarly, a direct search on the listed HS codes (27122010, 27129090,38122090, 38249090) (UNEP, 2019, p. 34) determined not imported.

3.3.5 Assessment of PCNs

As observed, several fire resistant adhesive products were quantified to contained 0.240 t of PCNs. A worldwide ban (Paun, PCNs Data Collection, 2020, p. 20) on open application of PCN products is obvious, thus making the above assessment value insignificant for reporting.

3.3.6 Assessment of PCBs (Annex A, Part II)

Similarly, an increase in imports of number of capacitors, condensers and transformers was observed. An estimated number of 78,000 capacitors and 79,000 transformers were recorded between 2010 and

⁴ National Airports Corporation

2019 appeared to be unrealistic, riddled with data entry errors. In addition, the quantities in using transformer oil that consist or contain PCBs in close applications with transformers was assumed to have increase as imports. Likewise, a number of oil-filled or oil-immersed high capacity transformers (>500V) were recorded to be imported.

This assessment had limitations on quantifying PCBs quantities, however a Tier II and Tier III investigation is required to assess the operational application of the transformer oils based on specifics required outlined in Article 15 reporting. As anticipated, a recent policy announcement to improve the electrification rate of the country had stimulated all the associated activities. Currently, electrification projects were recently rolled out throughout the country, likely to trigger increase in use of transformer oil and related products.

In so far as power generation is concerned, the aging power equipment including PCB contaminated transformers quantities and its residuals requires a comprehensive audit for eventual disposal and elimination.

3.3.7 Assessment of POPs- Pesticides (Annex A, Part I)

Absence of legacy pesticides known as “dirty dozen” indicated that world-wide elimination and restriction of POP-pesticides were effectively implemented. A small amount of 0.450 t of DDT’ clofenotane” was listed as imports that was not related to a traditional pest vector program.

Other POP-pesticides like *endosulfan* (technical) and *lindane* which, previously reported to be high (CEPA, 2019), was not found in this assessment. This indicated flaws in customs data entry allocations or either associated errors in data processing from source databases. Lack of ample data and information on pesticides does not indicate a decline in use of pesticides in all economic sectors. The use of alternative products was used to control pest infestation issues in agricultural industry.

In the past decade, the country has had experienced out breaks of both “cocoa pod borer” and “coffee pod borer”, that impacted yields in crop production. The national agriculture and quarantine inspection authority (NAQIA) team, whose responsible for pest control issues used alternative means to curb pest issues. The cocoa pod borer was resolved using a biological alternative.

As observed, an increased imports of agriculture-use insecticides such *glyphosates*, *paraquat*, and *chlorothanoni*, etc. were some of those that were listed under the Rotterdam Convention list of chemicals. In addition, an increase imports of biocides especially for use petroleum industry was observed. This may be attributed to an in water production at the oilfields that calls for treatment of water prior handling and disposal. Specific biocides such *Bactron* was used in large quantities in upstream crude oil processes.

Further comparison of current data assessment data on POPs-pesticides with the 2019 NIP data reported (Table 8) (CEPA, 2019) showed a contrasting discrepancy and large decrease in the quantities. Likely occurrence of discrepancies and errors may be related to processing of data extracted from the import trade database is highly possible.

As part of a progressive review, a close scrutiny of the active ingredients of many of the common listed pesticides especially those both registered in Stockholm (SC) and Rotterdam (RC) Conventions requires further investigation.

3.3.8 Assessment of Unintentional POPs (uPOPs)

Attempt to collated data and information for quantification of *polychlorinated dibenzo para dioxins* (PCDDs) and *polychlorinated dibenzofurans* (PCDFs) using the inventory questionnaire survey was unsuccessful. However, there is sufficient information available in the country to generate data for groups such as waste incinerations, power generation and heating, mineral production, and transportation.

Based on rough estimates there about more than 20 various types of incinerators operated across the country for different application. Similarly, the country hosts various types of power generation plants, mostly hydro power, diesel generators, gas powered and the geothermal. As for mineral production, it is limited to copper, gold, nickel and cobalt extractions.

3.4 Article 15 Reporting Requirements

Table 5 provides a detail list of Article 15 reporting requirements and current assessment data was applied based on life cycle steps of POPs. The footnotes provided were explanatory notes for NIP quantitative data. Since both reporting regimes relate well with more overlaps, a coherent plan should be appropriate to meet these requirements.

Table 5 List of likely overlaps of both NIP quantitative data and Article 15 reporting requirements. The POP quantities provided were from the assessment of PNG Customs import trade data for the period 2010 to 2019 only.

POPs group	Life-cycle step	NIP Quantitative data to be generated	Qty (Tonnes)	Unit measure	Remarks	
POPs pesticides	Production	POPs pesticides produced		Tonnes	Data requested by Art. 15 report	
	Import/ export	POPs pesticides imported/ exported		Tonnes	Data requested by Art. 15 report	
	Waste stockpiles	POPs pesticides containing waste stockpiles		Tonnes	Data requested by Art. 15 report	
PCP, its salts and esters	Production (historical/ current)	PCP, its salts and esters produced		Tonnes	Data requested by Art. 15 report	
	Import/export (historical/ current)	PCP, its salts and esters imported/exported		Tonnes	Data requested by Art. 15 report	
	Waste stockpiles	PCP containing waste stockpiles ⁵		Tonnes	Data requested by Art. 15 report	
PCBs	Production (historical)	PCBs produced		Tonnes	Data requested by Art. 15 report	
	Import/ export for environmentally sound disposal	PCBs imported/	.000	Tonnes	Data requested by Art. 15 report	
	Use/ Stockpiles/ Waste stockpiles	Equipment in service/ out of service			Number	Data requested by Art. 15 report
		Mass of equipment in service/out of service			Tonnes	Data requested by Art. 15 report
		Mass of liquids (oil) of equipment in service/out of service			Tonnes	Data requested by Art. 15 report
		PCB content in oil of equipment in service/out of service			Percentage (%)	Data requested by Art. 15 report
	Waste disposal	PCBs containing waste stockpiles locally destroyed			Tonnes	Data requested by Art. 15 report
PCBs containing waste stockpiles destroyed abroad				Tonnes	Data requested by Art. 15 report	
POP-PBDEs produced				Tonnes	Data requested by Art. 15 report	
POP-PBDEs	Production (historical)	POP-PBDEs produced		Tonnes	Data requested by Art. 15 report	
	Import/ export	POP-PBDEs imported/ (historical)	13.646	Tonnes	Data requested by Art. 15 report	
	Waste stockpiles	POP-PBDEs containing wastes stockpiles ⁶		Tonnes	Data requested by Art. 15 report	
DecaBDE	Production (historical/current)	DecaBDE produced		Tonnes	Data requested by Art. 15 report	
	Import/ Export	DecaBDE imported/ exported (historical)	17.851	Tonnes	Data requested by Art. 15 report	
	Waste stockpiles	DecaBDE containing wastes stockpiles ⁷		Tonnes	Data requested by Art. 15 report	
HBCD	Production (historical/current)	HBCD produced		Tonnes	Data requested by Art. 15 report	
	Import/ export	HBCD imported/exported ⁸	4.816	Tonnes	Data requested by Art. 15 report	
	Waste stockpiles ⁹	HBCD containing waste stockpiles		Tonnes	Data requested by Art. 15 report	

⁵ especially from timber treatment (for utility poles and cross-arms)

⁶ wastes of electric and electronics equipment (WEEE) and end-of-life vehicles (ELVs)

⁷ WEEE, textiles, insulation foams and ELVs

⁸ as powder or pellets, as master batches, as HBCD containing EPS beads and high impact polystyrene (HIPS) pellets

⁹ ((a) HBCD as chemical; (b) HBCD containing mixtures and articles; (c) HBCD-containing waste from demolition; d) HBCD-containing other wastes; (e) waste generated during recycling

PCNs	Import/export (historical/current)	HCBD imported/exported ¹⁰		Tonnes	Data requested by Art. 15 report
	Waste stockpiles	HCBD containing waste stockpiles		Tonnes	Data requested by Art. 15 report
	Production (historical/current)	PCNs produced ¹¹		Tonnes	Data requested by Art. 15 report
SCCPs	Import/export (historical/current)	PCNs imported/exported	.240	Tonnes	Data requested by Art. 15 report
	Waste stockpiles	PCN containing waste stockpiles ¹²		Tonnes	Data requested by Art. 15 report
	Production (historical/current)	SCCP produced, as allowed by the specific exemptions		Tonnes	Data requested by Art. 15 report
PFOS, its salts and PFOS-F	Import/export (historical/current)	SCCP imported/exported as allowed by the specific exemptions	26.269	Tonnes	Data requested by Art. 15 report
	Waste stockpiles	SCCP containing wastes stockpiles ¹³		Tonnes	Data requested by Art. 15 report
	Production (historical/current)	PFOS, its salts and PFOS-F produced as allowed by the specific exemptions/acceptable purposes		Tonnes	Data requested by Art. 15 report
	Import/export (historical/current)	PFOS, its salts and PFOS-F imported/exported as allowed by the specific exemptions/acceptable purposes	.434	Tonnes	Data requested by Art. 15 report
	Use (historical/current)	PFOS, its salts and PFOS-F used to manufacture article/products as allowed by the specific exemptions/acceptable purposes		Tonnes	Data requested by Art. 15 report
DDT	Waste stockpiles	PFOS, its salts and PFOS-F containing wastes stockpiles (especially firefighting foams and hydraulic fluids wastes)		Tonnes	Data requested by Art. 15 report
	Production (historical/current)	DDT produced		Tonnes	Data requested by Art. 15 report
	Import/export	DDT imported/exported	.450	Tonnes	Data requested by Art. 15 report
UPOPs	Waste stockpiles	DDT containing waste stockpiles		Tonnes	Data requested by Art. 15 report
	Unintentional production	Release estimates of PCDD/PCDF in air, water, land, product and residue		g-TEQ/year	Data requested by Art. 15 report
		Release estimates of PCBs air, water, land, product and residue		g-TEQ/year	Data requested by Art. 15 report
		Release estimates of PeCBz air, water, land, product and residue		g-TEQ/year	Data requested by Art. 15 report
		Release estimates of HCB air, water, land, product and residue (g-TEQ/year);		g-TEQ/year	Data requested by Art. 15 report
		Release estimates of PCN air, water, land, product and residue		g-TEQ/year	Data requested by Art. 15 report
		Release estimates of HCB air, water, land, product and residue		g-TEQ/year	Data requested by Art. 15 report
	Waste stockpiles	uPOPs containing wastes stockpiles		Tonnes	Data requested by Art. 15 report
			63.706		

¹⁰ as by-product (especially for use in agricultural sector, industrial manufacture, purification of gas streams and electrical equipment)

¹¹ for using as intermediate for the production of polyfluorinated naphthalene's (PFNs) or for other purposes

¹² especially cables containing PCNs, including POP-PBDEs and PCBs

¹³ (a) Additives in the production of transmission belts in the natural and synthetic rubber industry; b) Spare parts of rubber conveyor belts in the mining and forestry industries; c) Leather industry, in particular fatliquoring in leather; d) Lubricant additives, in particular for engines of automobiles, electric generators and wind power facilities, and for drilling in oil and gas exploration, petroleum refinery to produce diesel oil; e) Tubes for outdoor decoration bulbs; f) Waterproofing and fire-retardant paints; g) Adhesives; h) Metal processing; i) Secondary plasticizers in flexible polyvinyl chloride, except in toys and children's products)

3.5 Quantification of NIPs data and information

Similar to Article 15 requirements, the NIP module report template provided could not be filled out as requested, due to lack of data and information as shown in Table 5. A comprehensive inventory assessment of POPs in the country is required at more comprehensive levels of Tier II and Tier III data collection approach.

Besides Article 7 (NIP) as well as the Article 15 Reporting Obligations, Parties to the Stockholm Convention were required to provide other reports on the following;

- Action plan on release reduction of uPOPs in accordance paragraph (a)(v) of Article five (5) of the SC where a report is required to be submitted once every five (5) years;
- Progress on eliminating PCBs in accordance with paragraph (2)(g) of Part II under Annex A of the SC where a report is required to be submitted once every five (5) years;
- Progress on eliminating POP-PBDEs in accordance with Part IV (2) and Part V (2) of Annex A of the SC where a report is required to be submitted every four (4) years;
- DDT assessment including amount and conditions of DDT use as well as relevance to country's disease management strategy in accordance with Part II (4) of Annex B of the SC where a report is required to be submitted once every three (3) years.

As these reporting obligations have stalled, the foreseeable plans should include all these requirements. Similarly, some of these details were presented in Tables 12, 13 and 14 of the Gap Analysis report (Rivu, 2020), that required both the qualitative and the quantitative information and data.

4 Discussions

Distribution trends accorded to applications of POPs chemicals, articles and products in various economic sectors and the annual importation rates are discussed to identify likely impact areas within the country. Deliberations from these quantitative assessments reveals notable absence of many of the listed POPs especially those listed under Annex A of the Stockholm Convention.

4.1 Distribution based on Economic Sector

As earlier discussed, the use of specialized paints in construction developments were assessed in an integrative manner, that prominently contributed to PBDEs and SCCPs quantities. Further distribution details based on POPs quantities is presented in Appendix II including details of the short abbreviations shown in the graph below. As per the distribution plot (Figure 3), the prominent articles and products such as paints, electrical consumer goods, CRT TVs, and cars are distributed via the supply chain route. Imports on second hand motor vehicles were presented as private imports (Pvt-Imp) valued at 7.3 % of the total POPs quantity. Evidence obtained showed vehicles manufactured before 2004 were continuously being imported and can only be verified with motor vehicle insurances (MVIL)¹⁴ database, the entity responsible for vehicle registrations.

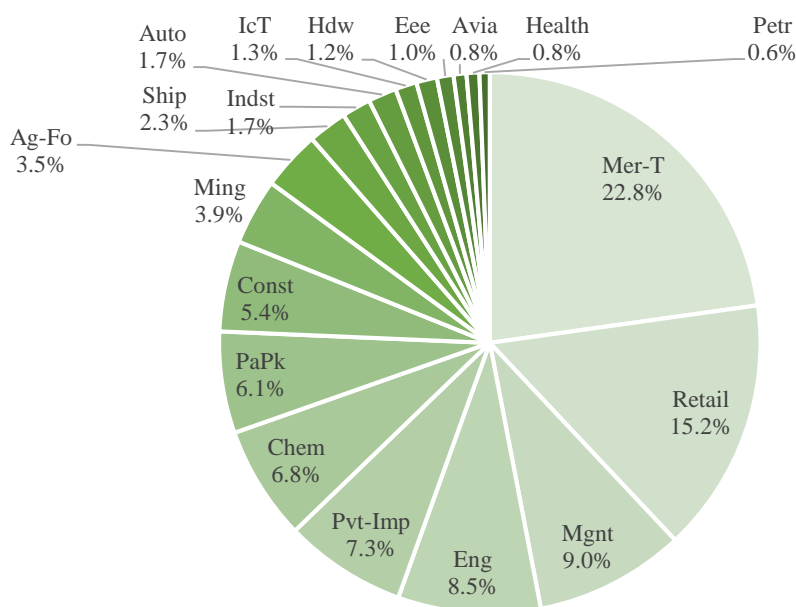


Figure 3 Distribution of POPs quantities for the period (2010-2019) based on economic sector derived from the activities of the consignee of the import

¹⁴ Motor Vehicle Insurance Limited

4.2 Annual distribution trends of POPs

General observations depicted in Figure 4 showed increased import of POPs articles and products. The surge in POPs quantities for years 2018 and 2019 was due to increase use of intumescent paints (decaBDE) and HIPs (HBCD) and importation of second-hand motor vehicles where values of decaBDE and c-pentaBDEs were the highest for the period. This increase for the latter was attributed to policy changes in reducing the customs import tariffs on second imported motor vehicles.

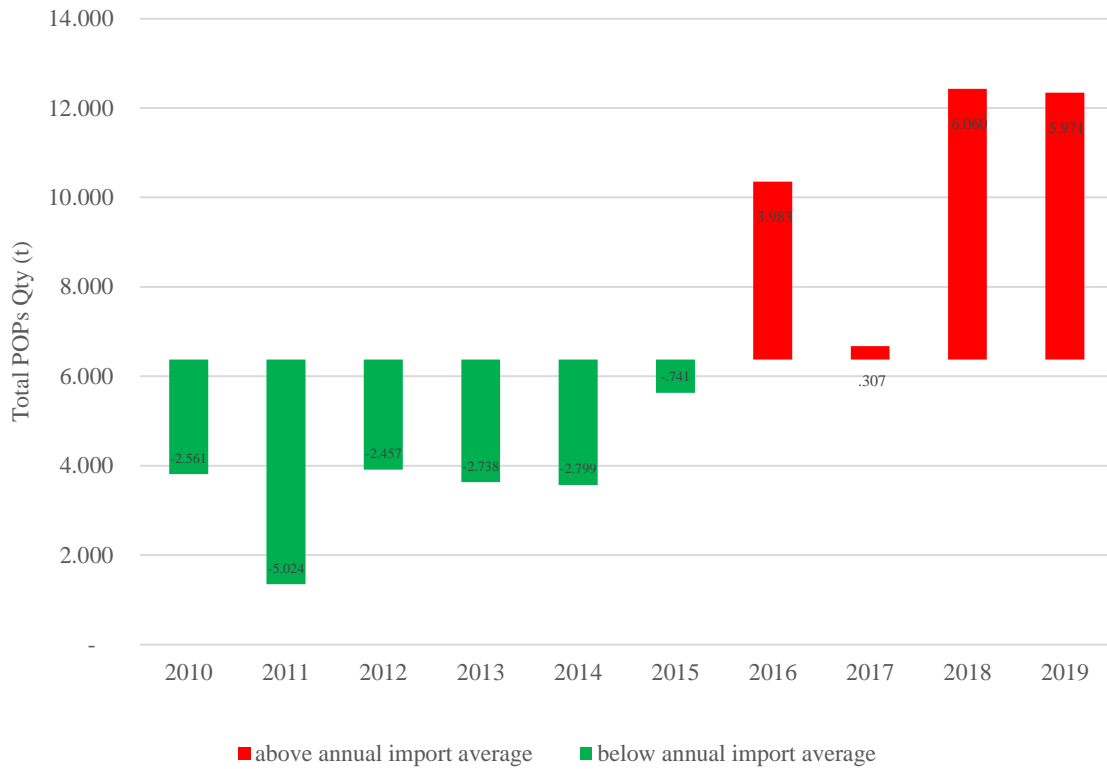


Figure 4 Annual import trend analysis showing POPs quantities showing values below (green) and above (red) the average value of 6,371 t

4.3 Distribution of POPs quantities by country origin

The major 30 countries listed in Table 6 were the main sources of the POPs chemicals, articles and products, which the top eight contributed 99% of POPs quantities. PNG (PG) is the default importer, but major trading partners were China (CN), Malaysia (MY), Australia (AU), Singapore (SG), Japan (JP), Hong Kong (HK) and Taiwan (TW) based on the total quantities of POPs. Both PBDEs, and SCCPs were prominent as major contributors of POPs quantities.

Table 6 Distribution of POPs quantities based the top 30 countries of origin

Country of Origin	n (10 ⁶)	Qty (t)	PBDEs(t)	HBCD (t)	PFO S (t)	SCCP s (t)	PCN s (t)	PCB s (t)	Pesticides	Total POPs (t)	% POPs
PG	18.219	130.025	19.216	3.610	.430	16.404	.240	.000	.178	40.078	62.91%
CN	1.901	44.199	5.160	.031		4.433			.272	9.897	15.54%
MY	.185	4.003	1.632	.000		1.916				3.548	5.57%
AU	.629	9.864	1.379	.653	.000	1.169				3.201	5.03%
SG	.177	2.835	1.069			1.026				2.095	3.29%
JP	1.613	.576	2.052			.000				2.052	3.22%
HK	.410	3.537	.546	.033		1.273				1.852	2.91%
TW	.012	.179	.012	.488						.500	0.79%
IL	.001	.026	.106							.106	0.17%
ID	.015	.183	.045			.034				.079	0.12%
BE	.002	.001	.077		.000					.077	0.12%
US	.032	.383	.029		.003	.012				.044	0.07%
NZ	.095	.779	.043							.043	0.07%
KR	.012	.131	.037							.037	0.06%
CZ	.004	.138	.036							.036	0.06%
TH	.023	.468	.028			.002				.030	0.05%
IN	.010	.216	.010							.010	0.02%
FJ	.003	.109	.004							.004	0.01%
VN	.074	.048	.004							.004	0.01%
ET	.001		.002							.002	0.00%
JO	.001		.002							.002	0.00%
PH	.007	.022	.001							.001	0.00%
GB	.001	.013	.001							.001	0.00%
XX	.001		.001							.001	0.00%
IT	.001	.017	.001							.001	0.00%
PL	.000	.016	.001							.001	0.00%
DE	.000	.003	.000		.000					.001	0.00%
AD	.000	.001	.000							.000	0.00%
TR	.000	.011	.000							.000	0.00%
KE	.000	.003	.000							.000	0.00%
Total	23.434	197.785	31.495	4.816	.434	26.269	.240	.000	.450	63.704	100.00%

4.4 Distribution of POPs by major importers (consignees)

Determination of POPs distribution by import consignee listing was significant, identifying users and locations these chemicals, articles and products. The investigative questionnaire survey can be directed to determine the levels of usages, sales, stockpiles, waste stockpiles and further identify contamination sites. In this assessment, the top 100 entities identified as importers of POPs were listed in Table 9 of Appendix III. There was a mixture of both the traditionally established companies and the new entities, mostly determined by the nature economic development projects. Though this distribution appears semi-qualitative, it also significantly reduces the imported POPs by 25% if the conditions are limited to factors based on total quantity, then rather by types of POPs.

4.5 Qualitative assessment of POPs in the country

Table 10 in Appendix IV provides a qualitative measure of the POPs situation in the country. This assessment revealed most of the POPs chemicals obsolete or were banded as imports. The only remaining 18 listed POPs were found present and was inventoried.

4.6 Data gaps in customs trade data and lack of related POPs information

As foreseen, the quality of PNG Customs imports trade data provided revealed various proportions of errors were attributed to reasons listed.

- Misallocated assigned HS codes of chemicals, articles and products; an issue identified that caused difficulty in sorting the data. These errors are most likely incurred during the data entry points.
- Duplicated quantities of items that appeared frequently, which may be related to data processing when extracted from database. For e.g. a listing of 10,000 buses for a given date was a typical related error encountered. Data of this sorts were treated as outliers and excluded in calculations of POPs quantities.
- Misapplied technical names of chemical, article and products. Chemical and trade names were frequently found misspelled.
- Lacked details on additional information provided, especially the technical names of chemicals and product specifications.

Data and information gaps associated with quantification POPs and the development of the inventory assessment remains a challenge. Project management of such nature requires a plan encompasses all reporting requirements and adhere to fulfilling the deliverables.

5 Conclusion

The quantitation of the import trade data in this study is only a small part of the inventory assessment of POPs content in the country, which only provide hints on the economic activities. Using this data and information provides ways to improve future inventory assessment work required to achieve data and information gaps on the usage, sales, stockpiles and waste stockpile levels in the country.

As observed, the imports on used, reconditioned and or second hand articles and products that contain or consist of POPs were on the increase. For example, motor vehicles manufactured during 2004 were currently imported. In future, this may become a waste management issue, therefore current development of waste management policies should include curbing quantities of such imports.

Improvements in applying UN environment programme guidance documents on assessing the raw customs trade data was achieved despite the discrepancies in the quality of the data. A good list of HS codes related to POPs, the improvements on sorting and evaluating the raw data was comprehensively established.

This desktop inventory assessment has delivered a more comprehensive data and information reflect and relate at most to the economic situation of the country. This was reflected in ascertaining about equal PBDEs and SCCPs values based on imports of chemicals, articles and products that consist or contain POPs. Unusually, a one of AFFF products were imported that likely to contained PFOS/PFOS and related salts. Some small quantities of DDT were also imported but were unrelated to a vector control program. Finally, both the PCNs and PCBs were negligible assumed to be found in products likely to be used in open applications.

The foreseeable plan and challenge is to take the study to levels of Tier II and Tier III of the data collection systems.

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7 Appendices

7.1 Appendix I

Table 7 Conversion factors (weights, polymer fraction, concentration factor) used in calculation of POP-PBDEs

Applications	POPs	Chemical/Articles/Products	wt, kg (mean)	f polymer concentration	Formula [wt*fp*f c]
EEE/WEEE	c-octaBDEs	Fridge/Freezer	38.86	3.60%	0.140%
		Cooker (counter top)	58.11	3.60%	0.209%
		Air conditioner/Dehumidifier	18.50	3.60%	0.067%
		Heater/Ventilator	13.00	3.60%	0.047%
		Iron/Presser	1.50	3.60%	0.005%
		Washing machine	65.00	3.60%	0.234%
		Camera	0.77	3.60%	0.003%
		Electric equipment	9.00	3.60%	0.032%
		CRT TV/Desktop	18.00	76%	1.372%
		Hair & Beauty item ¹⁵	1.00	3.60%	0.004%
		Small item ¹⁶	2.00	3.60%	0.007%
		Medium item ¹⁷	7.00	3.60%	0.025%
		CONSTRUCTION	decaBDE	PUR foam in insulations	
Extruded Polystyrene (XPS)				2.0%	
EEE/ICT	decaBDE	Flat screen monitors/displays	11.25	9.45%	0.106%
		Desktop computers (base unit)	10.00	9.45%	0.095%
		Mobile phone & accessories	0.50	9.45%	0.005%
		Printer/Scanner/Shredder	7.00	9.45%	0.066%
		Photocopier	52.00	9.45%	0.491%
		Laptop	3.00	9.45%	0.028%
		Telephone (telecommunication equipment)	5.00	9.45%	0.047%
		Radio	2.00	9.45%	0.019%
		ICT equipment	10.00	9.45%	0.095%
		Electronic equipment	7.94	9.45%	0.075%
PAINTS	decaBDE	Intumescent coatings ¹⁸		6.25%	
TRANSPORTATION	decaBDE	Motor vehicles(1975-2004) ¹⁹	80g/mv	0.0004	
		Motor Vehicles (2005-2017) ²⁰	20g/mv	0.0001	
TRANSPORTATION	c-pentaBDEs	Motor Vehicles (1975-2004) cars, trucks, utes	0.16	0.0008	
		Motor vehicles (1975-2004) buses	1.00	0.005	

¹⁵ e.g. hair dryer, foot massager, hair curlers, hair straighteners

¹⁶ - kettle, toaster, clock, sandwich maker, coffee maker, juicer, rice cooker, steamer, iron, food mixer

¹⁷ - bread machine, video camera, trouser press

¹⁸ Marine, metal, oxide, anti-rust, anticorrosion

¹⁹ =# of mv*80 g dBDE & 200kg polymer

²⁰ = # of mv * 20g dBDE & 200 kg polymer

7.2 Appendix II

Table 8 Distribution of POPs quantities for the period 2010-2019) based on economic sectors according to consignees business activities

Economic Sector	n (10 ⁶)	Qty (Mt)	PBDEs(t)	HBCD (t)	PFOS (t)	SCCPs (t)	PCNs (t)	PCBs (t)	Pesticides (t)	Total POPs (t)	% POPs
Merchant-Traders	2.858	41.031	7.051	.013	.000	7.064	.025			14.153	22.22%
Retail	4.688	74.835	6.099	.592		2.347			.414	9.452	14.84%
Management	1.358	6.826	2.747	.242		2.591	.001			5.581	8.76%
Engineering	.428	3.765	1.646	.001		3.644	.003	.000		5.293	8.31%
Private-Importer	4.539	2.145	2.451	.002		2.083				4.536	7.12%
Chemicals	.078	2.320	1.680	.033		2.478	.045			4.237	6.65%
Paper-Plastics-Packaging	.111	1.089	.289	3.272		.210				3.771	5.92%
Constructions	.116	1.945	1.036	.130		2.202	.000			3.369	5.29%
Mining	1.436	4.515	1.328			1.088			.036	2.452	3.85%
Agriculture-Forestry	1.805	.592	1.009			1.189				2.198	3.45%
Shipping	.020	.406	.651	.047		.752		.000		1.450	2.28%
Industrial	.129	2.314	.556	.369		.148				1.073	1.68%
Automotive	.595	.600	1.056			.000				1.056	1.66%
ICT	2.683	7.721	.796							.796	1.25%
Hardware	.502	17.286	.749	.010		.009	.000			.769	1.21%
EEE	.490	10.088	.538	.074		.004				.616	0.97%
Aviation	.057	.270	.041		.434	.002				.477	0.75%
Health	.348	10.563	.450	.026						.476	0.75%
Petroleum	.068	1.207	.134	.005	.000	.075	.166	.000		.381	0.60%
Embassies	.191	1.286	.217	.000		.076				.293	0.46%
Food-Beverages	.166	1.793	.174			.102				.276	0.43%
Fisheries	.021	.466	.143			.125				.268	0.42%
Hospitality	.345	1.254	.122			.071	-			.193	0.30%
Institutions	.087	1.195	.133			.003				.137	0.21%
Building-Construction	.044	.614	.080			.001				.081	0.13%
Furniture	.015	.167	.081			.001				.081	0.13%
Freight	.136	.514	.074	.000		.000				.074	0.12%
Properties	.032	.411	.063			.002				.065	0.10%
Power	.038	.020	.027							.027	0.04%
Finances	.028	.314	.026							.026	0.04%
Security	.016	.136	.020			.000				.021	0.03%
Transport	.011	.015	.019							.019	0.03%
Manufacturing	.001	.047	.007			.001				.008	0.01%
Media	.003	.061	.004							.004	0.01%
Pharmacy	.000	.002	.000							.000	0.00%
Textile	.000	.000	.000							.000	0.00%
Fisheries	.000	-	-							-	0.00%
Total	23.444	197.811	31.497	4.816	.434	26.269	.240	.000	.450	63.706	100.00%

7.3 Appendix III

Table 9 List of top 100 companies were listed showing major importers of POPs quantities in the country. Reduction in total POPs is due to restrictions on listed consignees.

Consignees	n (10 ³)	Qty	c-oc- taBDE	decaB DE	c-pen- taB- DEs	PBDE s	HBCD)	PFOS	SCCPs	PCNs	PCBs	Pesti- cides	POPs	% POPs
TERRITORY PACKAGING LIMITED	.003	.082	.000	.000	.000	.000	3.272						3.272	6.84%
R.H PARTS AND SERVICES LIMITED	11.246	.163	.002	1.339	.000	1.342			1.598				2.940	6.15%
CX INVESTMENT LIMITED	7.159	.204	.006	.733		.739			1.987				2.726	5.70%
DULUX GROUP (PNG) PTE LTD	.011	.021	.000	.990		.990	.033		1.188	.045			2.257	4.72%
BNBM (PNG) LIMITED	828.873	27.116	1.009	.244	.007	1.260			.283				1.543	3.23%
BRIAN BELL & COMPANY LIMITED	1,718.276	37.499	1.367	.147	.000	1.515							1.515	3.17%
AGMARK PACIFIC PTY LTD	5.118	.062	.001	.643	.000	.644			.768				1.412	2.95%
SOUTH PACIFIC PAINT LTD	6.299	.033		.330	.004	.334			.982				1.315	2.75%
RAMU NICO MANAGEMENT (MCC) LIMITED	97.851	1.627	.207	.283	.000	.490			.796				1.287	2.69%
NIUGINI PACIFIC INTERNATIONAL LTD	1,004.371			.402	.841	1.243							1.243	2.60%
CHINA RAILWAY INTERNATIONAL LTD	6.349	.159	.005	.002	.000	.007			1.129				1.136	2.38%
ASSOCIATED PLUMBING INSTALLATIONS	.014	.024	.000	.000	.000	.000	.942						.942	1.97%
YUAN FANG ARCHITECTURAL DECORATION	1.350	.040	.001	.249	.000	.250			.652				.902	1.89%
LEON ENTERPRISE LIMITED	82.932	2.331	.080	.280	.001	.360			.482				.843	1.76%
Z.BAILIN	.060	.007	.000	.000	.000	.000			.817				.817	1.71%
DICOS CORPORATION (PNG) LIMITED	.016	.007	.000	.228	.000	.228			.583				.811	1.70%
JURUDAYA CONSTRUCTION (PNG) LTD	.107	.008	.000	.000	.000	.000			.786				.786	1.64%
CRCG (PNG) LTD	.595	.013	.000	.036	.000	.036			.744	.000			.781	1.63%
H.Q.H ENTERPRISES LIMITED	145.400	3.848	.176	.282	.000	.458			.299				.756	1.58%
2G DEVELOPMENT CO.LIMITED	3.888	.078	.003			.003			.731				.733	1.53%
B.M.K INTERNATIONAL LIMITED	.218	.009	.000	.539		.540	.013		.156				.709	1.48%
XYZ CONSTRUCTION (PNG) LIMITED	45.736	.674	.147	.008	.000	.155			.535				.690	1.44%
PNG OXYGEN LIMITED	.067	.005	.000	.294		.294			.353				.646	1.35%
GOLD BELL TRADING LIMITED	.022	.005	.000	.285	.000	.285			.342				.628	1.31%
W.R CARPENTERS & COMPANY ESTATES	.002	.005	.000	.281		.281			.338				.619	1.29%
CHINA HARBOUR ENGINEERING COMPANY (PNG)	4.261	.105	.002	.097	.000	.099			.513				.612	1.28%
ORICA (PNG) LTD	.335	.008	.000	.255		.255	.000		.306				.561	1.17%
BISMARCK MARINETIME LIMITED	.104	.004	.000	.230		.230			.276				.506	1.06%
VENTURE PNG LTD	.060	.005	.000			.000			.480				.480	1.00%
TITAN CORP. LIMITED	7.432	.301	.014	.203		.216			.242				.459	0.96%
CONCRETE ENGINEERING LTD	1.659	.017	.001	.001	.001	.002			.443				.445	0.93%
NATIONAL AIRPORTS CORPORATION LTD	.530	.016	.000	.000	.000	.000			.429				.429	0.90%
CONSOLIDATED CONTRACTORS(PNG)Co.LTD	.079	.006	.000	.425	.000	.425							.425	0.89%
MANJACK INVESTMENT LIMITED	6.103	.003	.000	.189	.005	.194				.224			.419	0.88%
NGO HOLDINGS LIMITED	.026	.003	.000	.189		.189	.000		.226				.415	0.87%
PAPINDO TRADING COMPANY LIMITED	155.972	3.634	.134	.095	.041	.269			.143				.412	0.86%
LIHIR GOLD LIMITED	37.415	.375	.008	.402	.000	.410							.410	0.86%
LCK LIMITED	2.896	.003	.000	.182	.002	.184			.216				.400	0.84%
SUNSHINE GROUP WOODEN PRODUCT LIMITED	1.577	.065	.003	.178		.181			.214				.394	0.82%
NCI PACKAGING (PNG) LIMITED	.001	.003	.000	.175		.175			.210				.385	0.81%
KC 2 LIMITED	5.258	.089	.007	.168	.001	.176			.198				.374	0.78%
STEAMSHIPS LTD	.108	.003	.000	.170	.000	.170			.204				.374	0.78%
KIMBE BAY SHIPPING AGENCIES LTD	5.284	.242	.009	.161	.000	.170			.194		.000		.363	0.76%
DEKENAI CONSTRUCTIONS LIMITED	-	.005				-			.347				.347	0.73%

Consignees	n (10 ³)	Qty	c-oc-taBDE	decaBDE	c-pentaB-DEs	PBDEs	HBCD)	PFOS	SCCPs	PCNs	PCBs	Pesticides	POPs	% POPs
CITY PHARMACY LIMITED	253.237	8.994	.328	.010	.003	.342							.342	0.71%
WHEELS PTY LTD	186.322	.001	.000	.074	.263	.337							.337	0.71%
CHIN H MEEN & SONS LIMITED	222.312	7.660	.258	.057	.000	.315							.315	0.66%
HORNIBROOK NGI PTY LTD	10.973	.466	.017	.001	.000	.018			.277	.003			.297	0.62%
TRANSFIELD SERVICES (AUS) LIMITED	10.188	.098	.003	.134		.137			.159				.296	0.62%
RAUMAI NO 18 LIMITED	8.687	.151	.004	.004	.003	.011						.272	.283	0.59%
FLETCHER MOROBE CONSTRUCTION LIMITED	4.398	.196	.027	.257		.283							.283	0.59%
TOYOTA TSUSHO	71.278	.045	.007	.028	.226	.261							.261	0.55%
JIANGSU MINGDA CONSTRUCTION LIMITED	1.015	.014	.003	.067		.071			.159				.229	0.48%
OK TEDI MINING LTD	34.614	.506	.030	.094	.000	.124			.097				.221	0.46%
EXXONMOBIL PNG LTD	13.107	.161	.007	.040	.001	.048	.002		.001	.166			.218	0.46%
LILU FRIENDSHIP LTD	.542	.013	.003	.049		.052			.162				.214	0.45%
NAKO FISHERIES LTD	.020	.002	.000	.095		.095			.114				.209	0.44%
ALLIED GOLD/SIMBERI GOLD CO. LTD	1.046	.022	.008	.008	.000	.016			.193				.209	0.44%
LUCKY WINNER ENTERPRISES LIMITED	3.962	.083	.002	.094		.096			.110				.206	0.43%
PNG QUALITY CONSTRUCTIONS LTD	-	.003		-	-	-			.204				.204	0.43%
GIANTS HOLDINGS LIMITED	.278	.005	.000	.000		.000			.198				.198	0.41%
CLEAN-GREEN ENERGY	.025	.002	.000	.000	.000	.000			.197				.198	0.41%
POM INVESTMENT GROUP LIMITED	.356	.006		.000		.000			.195				.195	0.41%
RABAUL SHIPPING P/L	.128	.004	.000	.088	.000	.088			.105				.193	0.40%
KENMORE LIMITED	75.181	1.365	.049	.141	.001	.191							.191	0.40%
NAWAE CONSTRUCTION PTY LTD	.278	.004	.000	.083	.000	.083			.099				.182	0.38%
POROMAN COMPANY LIMITED	8.220	.302	.010	.003		.012			.166				.178	0.37%
TROPICANA PTY LTD	339.067	1.112	.058	.056	.000	.114			.063				.177	0.37%
ZHENGSHEG FOOD PRODUCTS LIMITED	.127	.006	.000	.079		.079			.095				.174	0.36%
ELITE MARINE LTD	1.707	.002		.078		.078			.094				.172	0.36%
Z.C.INVESTMENT LIMITED	.083	.001	.000	.077		.077			.092				.170	0.35%
GUORUN GROUP (PNG) LIMITED	.946	.035	.003	.075		.078			.090				.168	0.35%
ABLE COMPUTING (PNG) PTY LTD	192.711	1.456	.043	.125	.000	.168							.168	0.35%
CAKARA ALAM (PNG) LIMITED	4.424	.085	.003	.074	.000	.077			.088				.165	0.34%
WEWAK AGRICULTURE DEVELOPMENT LTD	.047	.002	.000	.073		.073			.088				.162	0.34%
MORESBY PLUMBING SUPP/SERV LTD	1.148	.013	.001	.070	.000	.071			.083				.154	0.32%
HEVILIFT LIMITED	.307	.002	.000	.000	.000	.000						.142	.142	0.30%
JKJ TRADING LTD	3.570	.133	.004	.062		.067			.073				.140	0.29%
MEISEI INDUSTRIAL CO. LTD	.026	.002		.137	.000	.138							.138	0.29%
ANITUA HOUSING SOLUTIONS LIMITED	.030	.001	.000	.000	.000	.000			.136				.136	0.28%
LAMANA DEVELOPMENT LIMITED	2.616	.052	.002	.000	.000	.002	.132			.001			.134	0.28%
AUSTRALASIA PACIFIC PANEL LTD	-	.017				-	.130						.130	0.27%
TAGO MARITIME SERVICES LIMITED	.002	.001	.000	.058		.058			.070				.129	0.27%
HARGY OIL PALMS PTY LTD	.736	.012	.000	.058	.000	.059			.069				.128	0.27%
NIVANI LIMITED	.231	.003	.000	.056	.000	.057			.068				.124	0.26%
HARDWARE HAUS LIMITED	73.509	2.581	.110	.013	.000	.123				.000			.124	0.26%
Total	5.722.517	104.526	4.164	13.136	1.401	18.701	4.525	.429	23.528	.215	.000	.414	47.812	100.00%

7.4 Appendix IV

Table 10 Qualitative review of most listed Annex A (SC) chemicals indicated as unlikely ⊗, most likely ◆ or likely ♦ being ascertained.

POPs	Production	Import	Export	Quantity Used/Sales	Stockpiles	Waste Stockpiles	Contaminated sites	Remarks
Aldrin	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
Chlordane	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
DDT	⊗	◆	⊗	◆	◆	◆	◆	Low imports sighted
Dieldrin	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
Endrin	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
Heptachlor	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
HCBz	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Assess as uPOPs
Toxaphene	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
Mirex	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
PCB	⊗	◆	◆	◆	◆	◆	◆	Legacy PCB oils & transformers
Chlordecone	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Obsolete/check product components
HBB	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Restricted imports
HCBD	⊗	◆	◆	◆	◆	◆	⊗	Restricted imports
a-HCH	⊗	◆	◆	◆	⊗	⊗	⊗	Assess for usage, sales & stockpile
b-HCH	⊗	◆	◆	◆	⊗	⊗	⊗	Assess for usage, sales & stockpile
Lindane	⊗	◆	◆	◆	⊗	⊗	⊗	Assess for usage, sales & stockpile
Endosulfan	⊗	◆	◆	◆	◆	◆	⊗	Assess for usage, sales & stockpile
Dicofol	⊗	◆	◆	◆	⊗	⊗	⊗	Restricted import
PCBz	⊗	⊗	⊗	⊗	⊗	⊗	⊗	Assess as uPOPs
SCCP	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
PCP	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
PCN	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
c-decaBDE	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
c-octaBDE	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
c-pentaBDE	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
HBCD	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
PFOS	⊗	◆	◆	◆	◆	◆	◆	Assess for usage, sales & stockpile
PCDD	◆	◆	◆	◆	◆	◆	◆	Develop toolkit on required groups
PCDF	◆	◆	◆	◆	◆	◆	◆	Develop toolkit on required groups