# National Implementation Plan (NIP) Update for the Stockholm Convention on Persistent Organic Pollutants (POPs) for Suriname

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# Prepared by:

Dr. Roland Weber

POPs Environmental Consulting

73527 Schwäbisch Gmünd

Germany

E-mail: roland.weber10@web.de

***for***

Environmental Health and Sustainable Development Department (EHS)

Caribbean Public Health Agency (CARPHA)

P.O. Box 1111

Morne Fortune, Castries,

Saint Lucia

Phone: 758 452 2501

E-mail: carphaslu@carpha.org

Caribbean Public Health Agency CARPHA

On behalf of:

The Government of Suriname,

The Cabinet of the President, Coordination Environment,

in fulfilment of its obligations under the Stockholm Convention

and

The Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region (BCRC-Caribbean)

BCRC
CARIBBEAN
Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean

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# Preface

Suriname signed the Stockholm Convention on Persistent Organic Pollutants (SC) in May 2002 and completed the process of ratification on 20 September 2011. In 2007, Suriname started with the initial preparation for implementation of the Global Environment Facility (GEF) funded project "Initial Assistance to Enable Suriname to fulfil its obligations under the Stockholm Convention on Persistent Organic Pollutants". The first National Implementation Plan (NIP) was developed and completed under the now defunct Ministry of Labour, Technological Development and Environment (ATM) responsible for environmental matters at that time. In 2014, the Republic of Suriname initiated the implementation of the Strategic approach to the International Chemicals Management (SAICM) project under which the Suriname Five Year National Action Plan for Sound Management of Chemicals (NAP) was formulated.

In 2015, the GEF approved financial support for the implementation of the regional project "Development and Implementation of a Sustainable Management Mechanism for POPs in the Caribbean", which is an integrated project for the Caribbean region, where the update of the NIP transpires. The United Nations Industrial Development Organisation (UNIDO) is the implementing agency and the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region (BCRC-Caribbean) is the executing agency of this project. The project aims to build both institutional and human resource capacity to deal with the impacts of POPs and unintentionally produced POPs (UPOPs) in eight (8) of the Caribbean countries who are Parties to the SC, including Suriname. The project's first component is to deliver updated NIPs for the participating countries. The NIP update also contains the action plans and approaches suggested by the NAP.

The NIP describes the background of the POPs issues in Suriname and the current situation of the POPs substances. Furthermore, the NIP details all the strategies and actions, which need to be undertaken to meet all the obligations of the Convention.

In Suriname the project is being executed by the Project Working Committee (PWC) composed of Government entities and academia. Coordination Environment in the Cabinet of the President (CM) is responsible for coordinating national activities directed towards the preparation of the updated NIP for Suriname. With the finalization of this document Suriname has completed one of the deliverables of the abovementioned project.

The Government of Suriname would like to express its sincere gratitude to GEF, UNIDO and BCRC-Caribbean for their support in implementing the project in the country. Special words of appreciation to all whom have contributed to the finalization of this document.

Sincerely,

Mr. Winston G. Lackin

Ambassador in charge of the Environment

Presidential Advisor

# Executive Summary

The Stockholm Convention (SC) on Persistent Organic Pollutants (POPs) became effective on 17th May 2004 and was ratified by the Republic of Suriname on 20 September 2011. The SC imposes a worldwide ban on the production and trade in certain pesticides (Aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, and toxaphene), two industrial chemicals (Hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs) and other unintentional POPs (polychlorinated dioxins and furans) from 2004 onwards. In 2009, the SC Conference of Parties (COP), by decisions SC-4/10 to SC-4/18, adopted amendments to Annexes A (elimination), B (restriction), and C (unintentional production) of the SC to list nine additional chemicals as POPs. These nine chemicals include pesticides: Chlordecone, alpha-hexachlorocyclohexane (HCH), beta-HCH, lindane, pentachlorobenzene (PeCB); industrial chemicals: tetrabromodiphenyl ether and pentabromodiphenyl ether; hexabromobiphenyl, hexabromodiphenyl ether and heptabromodiphenyl ether, PeCB, perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride, and by-products: alpha-HCH, beta-HCH and PeCB.

In 2011, the COP through its decision SC-5/3, adopted an amendment to Annex A (elimination) listing technical endosulfan and its related isomers. In 2013, the COP in its decision SC-6/13, adopted an amendment to Annex A (elimination) by including hexabromocyclododecane (HBCD). In 2015, through its decisions SC-7/12, SC-7/13 and SC-7/14, the COP adopted amendments to Annex A (elimination) and C (unintended production) listing hexachlorobutadiene, pentachlorophenol and its salts and esters and polychlorinated naphthalenes. In 2017, through its decisions SC-8/10, SC-8/11 and SC-8/12, the COP adopted amendments to Annex A (elimination) and C (unintentional production) by adding decabromodiphenyl ether (commercial mixture, c-DecaBDE), short chain chlorinated paraffins (SCCPs) and hexachlorobutadiene (HCBD).

The current updated NIP has addressed the POPs listed up to 2015 (COP 6). In the action plan activities are also included to address the POPs listed in 2017 (COP 7).

The goals of the NIP are:

I. To set out the actions that Suriname has undertaken regarding the reduction of the presence of POPs;

II. To propose actions that Suriname will undertake to manage and eliminate POPs from entering the environment considering the Convention;

III. To inform the COP and Surinamese community about national initiatives and projects designed to meet the requirements of the SC.

The updated NIP describes how Suriname will fulfil its obligations under the SC to eliminate or reduce POPs-releases and carry out environmentally-sound management of stockpiles of POPs contaminated wastes and contaminated sites that pose high risks to human health and the environment, with a regional perspective.

Coordination Environment (CM) at the Cabinet of the President of the Republic of Suriname is the SC Focal Point (FP) and coordinates all activities regarding the implementation of the SC, inclusive of the NIP. This NIP update is formulated under the GEF #5558 project "*Development and Implementation of a Sustainable Management Mechanism for POPs in the Caribbean" (2015-2020)*".

The NIP comprises of three chapters:

- Chapter 1 provides an overview of the aims and goals of the NIP, as well as the process for the development of the NIP;
- Chapter 2 outlines Suriname's demographic, political and economic status and it gives basic information on Suriname's status regarding the management of POPs;
- Chapter 3 presents an overview of recommended activities, strategies, and action plans. In addition, there is a budget related to the activities of the action plan.

During the NIP update, the situation of the relevant POPs for Suriname has been assessed and inventories for these POPs have been developed and the situation and improvement needs were compiled.

**Persistent Organic Pollutants (POPs) pesticides (Section 2.3.1)**

The Government has made serious efforts to ban pesticides, which were identified as dangerous for humans and the environment. All POPs pesticides listed under the SC in Annex A are banned with the exemption of chlordecone and PeCB. These have not been banned but are not registered or used.

The pesticide stockpiles have been removed from the related storage sites in a regional United Nations Food and Agricultural Organization (FAO) project and exported for destruction. Therefore, the highest exposure risk of the waste pesticides formerly stored at these sites has been eliminated.

Suriname does not have facilities to produce pesticides. Suriname imports considerable amounts of pesticides for controlling pest and diseases in the agricultural industry. Private companies that are specifically focused on the agricultural sector import these pesticides. Household insecticides are also imported — although to a smaller extent than the agricultural pesticides.

Since 2005, the use of pesticides has almost doubled. However, there are not enough systems in place to sufficiently guide the safe use. Imported pesticides might contain counterfeit pesticides which possibly contain POPs. In general, there is insufficient dissemination of risk-related information to transportation companies, salespersons, and users. Also, suppliers and users are not familiar with the procedures of risk management. The mixing of pesticides is generally practiced without knowing the specific risks and impacts to human health. However, since the 1990s, there has been a trend towards using environmentally-safer pesticides.

A program on Integrated Pest Management (IPM), implemented by the Caribbean Institute and financed by the Global Environment Facility (GEF) – Small Grants Programme (SGP) and the Suriname Aluminium Company L.L.C (ALCOA) foundation, has been initiated by Ministry of Agriculture, Animal Husbandry and Fisheries (LVV). This Project “Promotion of Organic Agriculture: The Answer to Land Degradation and POPs for the Farmers in the District of Saramacca”, introduced organic cultivation and biological pest-control so that fertilisers and synthetic pesticides are no longer used.

DDT (listed in Annex B of the convention) is prohibited based on the 1999 regulation of Ministry of Trade and Commerce and Tourism (HI&T), and the 2005 ban on pesticides by LVV. DDT has not been imported since the beginning of the 80s, and the Government decided in 1981, to bury the then-existing stock.

Between 1958 and 1982, Suriname intensely used DDT for malaria control mainly in the Interior of the country. Resistance among mosquitoes against DDT was found. In the second part of the 1980s and early 1990s the use of synthetic pyrethroids was gradually introduced, and by the end of the 90s, these insecticides were the only ones used in the malaria vector-control strategies. However, because of the high costs of the pyrethroids alternatives, these can only become available through donor projects, which provide funds to purchase these alternatives. These alternatives need more frequent spraying, as they are less persistent than DDT.

Suriname reported no DDT spraying has been done — although it was one of the most highly malaria-ridden countries of the Americas (PAHO 1994). To control malaria, the Ministry of Public Health (VG) implemented the World Health Organization (WHO) Global Malaria Programme which resulted in reducing the number of reported malaria deaths that fell from 24 in 2000, to one death in 2009; this can be seen as great success. These achievements are strongly associated with the scaling-up of anti-malaria interventions. The programme has delivered a total of 22,490 long-lasting insecticide-treated mosquito nets (LLINs) during 2007–2009, enough to protect 79 % of the population at high risk.

In February 2011, the Government signed a bilateral agreement with French Guiana to fight against the Aedes Aeqypti mosquito, an insect well-known in tropical and sub-tropical climates worldwide. This mosquito may carry the virus that causes the much-feared Dengue fever in humans. This Dengue project is supported by the Agence Française de Développement with the help of the Conseil Général of French Guiana, together with Surinamese counterpart, namely VG. *Bacillus thuringiensis israelensis* (BTI) will be used for the destruction of the mosquito larvicide. BTI is a proven, environmentally-safe mosquito larvicide that is non-toxic for people. The product destroys the insect in its larval state and is also effective against adult insects.

### Polychlorinated biphenyls (PCB) and polychlorinated naphthalenes (PCNs) (Section 2.3.2)

PCB-containing equipment and materials, such as transformers, capacitors, hydraulic oils, and possibly open applications (eg. paints, cables etc.) have been imported in the past into Suriname. Most PCB-containing or contaminated equipment can be found in the electricity generation sector, which is owned by both public and private companies.

Currently, the import of PCB-containing materials is not forbidden. A permit of HI&T is required for the import of PCB-containing equipment. Transformers currently imported do not contain PCB. In addition, this equipment can contain PCNs which have been used in the same application largely from 1930s to the 1970s but at much lower volumes than PCBs.

Some PCB-containing equipment has been managed and exported for destruction. In 2005, the Government of Suriname signed a bilateral agreement for a period of two years with the Ministry of Environment from the Netherlands to facilitate shipments of PCB-waste to the Netherlands. The waste was collected from the Suriname Aluminium Company (SURALCO), a subsidiary bauxite mining company from ALCOA, and, a small part, from the BHP Billiton. The total PCB waste and scrap PCB transformers exported, amounted to one 20 feet and eight 40 feet containers, respectively.

PCB containing equipment is mostly used for electricity generation and can be found in electrical devices such as transformers and capacitors. According to a list provided in 2017 by the Energy Company of Suriname Limited (N.V.EBS), the public-owned electricity generation company, the company has 10,784 registered transformers. There are also private companies that possess transformers and capacitors.

N.V.EBS has established a priority list for monitoring of transformers including:

a) 50 waste transformers; and

b) 900 distribution transformers in the electricity network.

In an assessment of capacitors in the first NIP development no PCB-containing capacitors have been found.

N.V. EBS has established policy for the management of PCBs, awareness and a Sound Environmental Management system. The N.V. EBS has developed an internal program that informs and raises awareness of its personnel. The aim of the program is to provide information on how to protect the environment and humans while carrying out relevant duties, as well as how to manage transformers, especially those manufactured and installed between 1960 and 1985. Procedures regarding safety and PCB waste-oil management (handling, storage and destruction) were developed. Labelling of distribution transformers older than 1985 is conducted. Also monitoring by visual inspection of leaks or oil spots from the transformers is done. Furthermore, the maintenance of transformers is done using PCB-free oils and equipment therefore no equipment is newly contaminated.

In 2016, a component for PCB Management under the GEF Regional POPs Project (#5558) led by the BCRC-Caribbean had conducted a rapid regional PCB assessment. Within the rapid assessment project 3 out of 40 tested transformers from N.V. EBS contained PCB at concentrations between 53 and 570 mg/kg. It is expected that the assessment of transformers will continue within this project component. In the future the PCB-containing oils and equipment will likely be sent to licensed facilities abroad. Currently, there is no interim storage for PCB-containing equipment in Suriname that meets international standards. Such storage will be needed for PCB-contaminated equipment in that instance.

Although data has not been presented, it is assumed that PCBs in ‘open applications’, such as paints, caulking, hydraulic systems, have been used in the past. Since PCNs and SCCPs have recently been listed as POPs in 2015 and 2017 respectively, these open applications must be assessed also for these POPs.

**Listed polybrominated diphenyl ethers and hexabromocyclododecane (HBCD) (Section 2.3.3)**

Polybrominated diphenyl ethers (PBDEs) are brominated flame retardants (BFRs) used in various products such as plastic in electronics, polyurethane foams in vehicles and, textiles, to reduce their fire hazards by reducing the ignitability to meet certain fire safety standards. Three commercial mixtures were produced and used in the market: commercial PentaBDE (c-PentaBDE), c-OctaBDE and DecaBDE. Homologues of all mixtures are listed in the annexes of the SC. While c-PentaBDE and c-OctaBDE production has stopped and they are only present in products produced before 2005, the production of DecaBDE listed in 2017 continues with a range of exemptions.

In this first assessment POP-PBDEs included in c-PentaBDE and c-OctaBDE were addressed. DecaBDE listed in 2017 is not addressed in this NIP update but partly covered by the action plan.

The total plastic imported in televisions (TVs) and computers with cathode ray tubes (CRTs) is estimated to be 969 tonnes between 2001 and 2016 (the inventory year), containing 1025 kg c-OctaBDE. Since CRTs have also been imported in the 1960s to 2000 these values are probably 3 to 6 times larger.

The estimated total amount of plastic of CRTs in use or stocked is estimated to be 88 tonnes, containing 129 kg c-OctaBDE (including 70 kg POP-PBDEs).

No e-waste management has been established in Suriname - a large part of the Waste Electrical and Electronic Equipment (WEEE) is stored or dumped. It is assumed that the CRT imported in 2006 and earlier have largely ended in landfills. Based on this assumption it is estimated that the CRTs units imported in the period 2001-2006 (881 tonnes) have already largely ended up in the landfills containing 896 kg c-OctaBDE (480 kg POP-PBDEs). The total volume of disposed CRTs is, however, probably 3 to 6 times larger considering the abovementioned imports from 1960s to 2000 which have largely entered end-of-life.

c-PentaBDE has partly been used in polyurethane foams in seats or headrests in cars and other vehicles. The total amount of POP-PBDE in imported cars, buses and trucks and imported between 1998 and 2013 were estimated to be 1032 kg POP-PBDE. Based on additional data of registered vehicles in 1998 a total historic amount of imported POP-PBDEs in vehicles to Suriname can be estimated to be 1688 kg. The amount of POP-PBDE in the registered vehicles was estimated to be 620 kg, mainly from cars (442 kg) and less from trucks (121 kg) and buses (58 kg) and the total amount of POP-PBDE in end-of-life vehicles (ELVs) is estimated to be 1067 kg POP-PBDEs.

According to scrap dealers the interior such as seats, dashboards, etc. are taken out before export. These polymers together with polyurethane foam containing PBDE (and other flame retardants) are mainly dumped and partly burnt in the open. The PBDEs are contained in the polymer fraction. Therefore, the task is the management of the polymer fraction of vehicles. The total amount of all polymers in cars in use in 2015 is estimated to 29,200 tonnes. Additionally, trucks and minibuses contained 6887 tonnes and 1443 tonnes of polymers respectively.

HBCD was listed as a POP in 2013. It was used mainly (90 %) in expanded and extruded polystyrene (EPS/XPS) in building insulation with minor use in textiles and in electronics. HBCD is still produced and used in expanded and extruded polystyrene (EPS/XPS) foam for insulation in construction, which has been exempted under the Stockholm Convention. From 2009 to 2014 a total of 1983 tonnes of EPS and 344 tonnes of XPS has been imported to Suriname with up to 9.9 tonnes and 6.9 tonnes of HBCD in construction respectively. This can be considered an upper estimate since during the inventory no certified information was available. Considering the current stock of EPS/XPS in buildings and a use of 30 to 50 years only minor amount of Expanded Polystyrene/ Extruded Polystyrene (EPS/ XPS) will enter the waste stream in short term.

Suriname has no specific flammability standards for furniture/mattresses, but these materials are also imported from the USA having specific flammability standards with associated use of PBDEs in the past.

Currently, there is no formal or institutional recycling of e-waste (WEEE), end-of-life vehicle or other POP-BFR-containing waste in Suriname. Recycling is mostly done by the Informal sector. WEEE is not separated from domestic waste. Most of the waste is taken to the dumpsite (open dumping) where waste pickers remove any waste with economic value and sell it to interested retailers.

**Hexachlorobutadiene (HCBD) (Section 2.3.4)**

Suriname does not produce HCBD and has no organochlorine production process where HCBD could be generated at levels where HCBD separation for intentional production is possible. There is also no import of HCBD as products. Minor amount of unintentionally HCBD might be imported in perchloroethylene used for dry cleaning.

No current intentional use of HCBD has been discovered in Suriname. Since HCBD has been used to a minor extent in transformers or as hydraulic fluid, minor amounts might be in use. HCBD might have been used in the former aluminium smelter for refining but operation has stopped.

HCBD that might be present in transformers would be managed within the frame of PCB management. Waste from dry cleaning using perchloroethylene, which might contain impurities of HCBD is disposed of at dumpsites. Residues from the former aluminium smelter might have contained HCBD and have been disposed in a landfill without specific lining and can be considered a potential contaminated site.

**Dichlorodiphenyltrichloroethane (DDT) (Section 2.3.5)**

Between 1958 and 1982, DDT was used extensively to control malaria in the Interior of the country. In the second part of the 1980s and early 1990s the use of synthetic pyrethroids was gradually introduced, and by the end of the 90s, these insecticides were the only malaria vector-control strategy used.

DDT has not been imported since the beginning of the 80s, and therefore the Government decided in 1981, to bury the then-existing stock. In 1999, the import of DDT chemicals was prohibited under the Rotterdam Convention (RC). DDT is prohibited based on the 1999 regulation of HI&T, and the 2005 ban on pesticides by LVV.

However, because of the high costs of the pyrethroids alternatives, these can only become available through donor projects, which provide funds to purchase these alternatives. It is noteworthy to mention that these alternatives need more frequent spraying, as they are less persistent than DDT. Resistance among mosquitoes against DDT was found.

**Perfluorooctane sulfonic acid (PFOS) and related substances (Section 2.3.6)**

The major stocks of PFOS in Suriname are firefighting foams. An inventory of firefighting foams – import, current stocks and major use sites - has been compiled. The total amount of all stored firefighting foam in Suriname is estimated to be 275.6 tonnes (containing up to 1378 to 2756 kg of PFOS), where the major stock with 206 tonnes is at the oil storage facilities.

A PFOS related substance (sulfluramid) was used as insecticide against ants in Suriname since 2006 and until 2014 and is now prohibited. In total 15,000 kg sulfluramid with 0.5 % PFOS content (75 kg PFOS) has been imported to Suriname. This was used for ant infestation in residential, industrial and commercial areas throughout Suriname. There are likely some stocks in private households and at companies.

In Suriname, synthetic carpets (tufted carpets) are widely used. The inventory of the major carpet stores showed a total stock of 38,300 $m^2$ of synthetic carpets. PFOS-treated textiles and paper have shorter life cycles compared to carpets and the PFOS-treated textiles and papers that were produced before 2002 have largely reached their end-of-life and are in landfills and dumpsites with release potential.

Other per and polyfluorinated alkylated substances (PFASs) are not listed in the SC, but perfluorooctanoic acid (PFOA) has been assessed by the POPs Review Committee (POPRC) and will be listed as POPs in 2019. PFAS have been listed as issue of concern under the SAICM and PFOS and related substances are listed under SC

**Unintentionally produced POPs (UPOPs) (Section 2.3.7)**

The inventory of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) has been compiled for inventory year 2015 as an update of the baseline inventory from 2010.

The estimate total annual PCDD/F release is approximately 77.7 g TEQ for 2015, where:

- The major emissions were open waste burning (42.1 g TEQ; 54% of total release) including burning on landfills/dumps (38.3 g TEQ/year) and private waste burning (3.47 g TEQ/year).
- The second largest source was the use of 2,4-D and derivatives (55,800 tonnes formulation) with an estimated PCDD/F release of 29.0 g TEQ corresponding to 37.2 % of total emission for 2015.
- Other smaller sources with potential local impact are hospital waste incinerators, metal smelting, and chlorine production.

Furthermore, the PCDD/F inventory from former PCP-use for all former rice fields in Suriname between 1964 and early 1970s is estimated to be approximately 5565 g I-TEQ.[1] While this is not a current release, this historic release can have current impact. Accumulation in the food chain might pose a threat to human health.

A comparison of the recalculated baseline inventory from 2010 (80.4 g TEQ) with the updated inventory from 2015 (77.7 g TEQ) demonstrated a slight overall decrease of 2.4 g TEQ (3%) mainly caused by a decrease in 2,4-D use. There was a slight increase in release from open waste burning (42.2 g TEQ compared to 41.25 g TEQ) observed due to the increase in waste generation due to increased consumption. PCDD/Fs are representative of other unintentional UPOPs in sources present in Suriname and a reduction of PCDD/F would result in a similar reduction of other UPOPs.

**Contaminated sites (Section 2.3.8)**

For all the different POPs groups, potentially contaminated sites were discovered during the inventory development. Some of these have likely contemporary exposure to humans and need urgent assessment.

**Pesticides:** Information on contaminated soil and groundwater present at storage sites (old and currently in use) is not available. Based on the POPs-site inventory from the first NIP, it is assumed that a certain number of the storage sites, the soil, and the groundwater are possibly contaminated.

Within the region, the FAO's initial samples have been taken and will be analysed.

**PCBs/PCNs:** A range of potential PCB-contaminated sites has been identified during conduct of the inventory. PCB-contaminated sites are related to PCB-storage sites and where PCB transformers have been operated. Other sites are areas where transformers were maintained and landfills where wastes from companies possessing PCB-containing equipment have been dumped, or sites where scrap metal is sorted and recycled.

**PBDEs/HBCD:** The main part of WEEE generated are collected and disposed with the general domestic waste. Some WEEE is disposed of with household waste or dumped along roads or in deserted plots. Most PBDE-containing waste is disposed of at the dumpsites. There is some smouldering of e-waste and cables by the informal sector, which results in contaminated soils at these areas.

The country has 9 official dumping sites (one in each district) and many other illegal waste dumping sites are scattered throughout the country. None of the official dumping sites comply with international standards or are equipped with measures to avoid emissions of hazardous substances to the environment.

Dumping of waste results in emissions of hazardous substances to the environment, mainly air, soil and underground water or nearby surface water sources. All the dumping sites and sites where these polymer fractions are disposed have frequent open-burning activities, which result in releases of POPs present in

[1] This is rather an underestimation of total release from historic PCP-use in Suriname since PCP has most probably been applied already before 1964. As basis of the calculation, available data on PCDD/F content in PCP formulation from the 1960s and the early 1970s have been used for this estimate from Masunaga S, Takasuga T, Nakanishi (2001) J Chemosphere 44, 873-885.

the waste and the formation of UPOPs including PCDD/Fs and brominated PBDD/Fs.[2] Over time these sites and the surrounding soils can become contaminated with these POPs.

**PFOS** is highly persistent and no degradation is known in soil and groundwater. Therefore, the PFOS released in the last 50 years to soil and ground- and surface water have likely accumulated in these environmental matrices or have been further transported in the environment. Therefore, sites where PFOS have been released to the environment can be considered potentially contaminated sites. In Suriname, several potential PFOS-contaminated sites were identified, with potential contamination of a major drinking water reservoir. Due to the exposure risk, these sites and potentially impacted water need to be assessed and measured.

The use of ant powder and ant baits containing sulfluramid (precursors to PFOS) in private households has resulted in hot spots in homes and gardens. Additionally, a wide range of consumer products including treated synthetic carpets, furniture, textiles and surface-treated paper partly contain PFOS and related substances have been and are disposed of at dumpsites (in Suriname) with associated release/leaching to ground and surface water.

**PCDD/Fs and other UPOPs.** Today the largest amounts of PCDD/Fs present are from historic releases of the chlorine and organochlorine industry, from the application of organochlorine pesticides, and historic releases from metal industries. These PCDD/Fs released in the past have contaminated soils and sediments[3]

Potential or likely contaminated sites are:

- Historic applications of pentachlorophenol (PCP) in agriculture areas (5565 g I-TEQ) and wood treatment sites
- Areas where 2,4,5-T and contaminated 2,4-D have been used
- Chlorine production and disposed residues
- PCB contaminated sites (PCDD/F)
- Metal smelter releases and disposed ashes
- Incinerator releases and disposed ashes.
- Dumpsites and backyard burning

**Policy statement and strategies for implementation for POPs management (Sections 3.1 and 3.2)**

Section 3.1 contains the policy statement. Section 3.2 describes the strategies and considerations for the implementation of the NIP including:

- Inter-ministerial and stakeholder coordination considering national priorities
- Adequate legal, institutional, administrative and technical infrastructure
- Synergies among related Multilateral Environmental Agreements (MEAs)
- Addressing POPs phase out and use of alternatives within Sustainable Consumption and Production (SDG12) implementation

At the Governmental level, all relevant ministries will be involved in the NIP implementation in which each ministry will have different responsibilities with respect to its function. This inter-ministerial coordinating mechanism is considered vital in addressing chemicals and waste management (including POPs) at large. Chemicals and waste/resource management has been listed and highlighted as one of 8 national priorities[4] and as important topic areas contributing to several SDGs of the 2030 Sustainable Development Agenda.

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[2] Gullett BK, Wyrzykowska B, Grandesso E, Touati A, Tabor DG, Ochoa GS (2010) PCDD/F, PBDD/F, and PBDE emissions from open burning of a residential waste dump Environ Sci Technol. 44(1):394-399.

[3] Weber R, Gaus C, Tysklind M et al (2008) Dioxin- and POP-contaminated sites—contemporary and future relevance and challenges. Env Sci Pollut Res 15, 363-393.

[4] Republic of Suriname (2013) National Report in preparation of THE THIRD INTERNATIONAL CONFERENCE ON SMALL ISLAND DEVELOPING STATES (SIDS). Paramaribo, July 2013.

Responsibilities related to the sound management of chemicals and waste as well as those involved in activities that influence chemical safety, including governmental institutions, the private sector, industry, labour, science and public interest groups will be assigned. The strategy considers that a well-established science-policy interface is critical in shaping environmental governance and sustainable development.

The activities will be coordinated with the national action plan of Strategic Approach to International Chemicals Management (SAICM). SAICM has related emerging policy issues and issues of concern, which are considered in the action plan where appropriate (e.g. highly hazardous pesticides (HHPs), PFAS, or hazardous chemicals in the life cycle of electronics). Furthermore, the SC implementation considers the synergies with the Basel Convention (BC) and Rotterdam Convention (RC), which Suriname has ratified.

**The Section 3.3 of the NIP outlines the action plans,** including respective activities and strategies, for POPs management in Suriname, as well as performance indicators, suggested time frames for implementation, and implementers considered relevant and participating implementers and stakeholders.
Individual action plans have been developed for:

- Institutional and regulatory strengthening measures including development of legislation
- Measures to reduce or eliminate releases from intentional production and use (Article 3)
- POPs pesticides and highly hazardous pesticides (SAICM synergy) - import and export, use, stockpiles/waste and disposal as well as implementation of Integrated Pest Management (IPM) and organic farming
- PCBs – inventory, storage, management, import and export, use, and disposal
- POP-BFRs (PBDEs, HBCD and HBB) – regulation and life cycle management
- PFOS and related substances – legislation, life cycle management and synergies use, stockpiles, and wastes. To promote the synergy of the SC and SAICM, the action plan is extended where appropriate to other PFAS which are an issue of concern in SAICM
- Register for specific exemptions and the need for exemptions (Article 4)
- Measures to reduce releases from unintentional production (PCDD/Fs and other UPOPs) including integrated pollution prevention and control (Article 5)
- Identification and management of stockpiles, waste and articles in use, including release reduction and appropriate measures for handling and disposal (Article 6)
- Identification of POPs contaminated sites (Article 6)
- Facilitating or undertaking information exchange and stakeholder participation (Article 9, 10)
- Public/stakeholder awareness, information awareness and education (Article 10)
- Effectiveness evaluation (Article 16)
- Reporting (Article 15)
- Research, development and monitoring/analytical capacity (Article 11)

Also, an action plan on technical and financial assistance (Articles 12 and 13) has been developed (in Section 3.3) to enable the country to obtain the needed financial and technical support required for the successful implementation of activities and actions to be carried out to achieve the overall objectives of the Stockholm Convention.

**In Section 3.4, priority activities and capacity building are compiled.** The priority activities include:

- Coordination mechanism between ministries, institutions and stakeholders for POPs and chemical and waste management
- Institutional strengthening and regulatory development and implementation
- Education, information and awareness-raising
- Manage of POPs stockpiles (PCBs/PCNs, pesticides, POP-PBDEs, HBCD and PFOS)
- Improvement of waste management and introduction of waste hierarchy for reduction of unintentionally formed POPs from open burning

- Best Available Techniques/ Best Environmental Practices (BAT/BEP) for PCDD/Fs and other UPOPs reduction and integrated pollution prevention and control
- Monitoring of POPs, effectiveness evaluation and initiate research and collaborations
- Substitution of POPs in use and selection of green and sustainable alternatives
- Contaminated site assessment and management

**In Section 3.5,** reference is made to the **suggested time lines in the individual action plans.**

**In Section 3.6, the financial resources needed for implementation of priority activities** are estimated to the extent possible while for a range of activities information needed will be generated during the implementation of the NIP. The ability of the country to fulfil its obligations under the SC depends on adequate financial and technical assistance. Suriname needs technical and financial assistance and will seek this assistance when implementing its NIP.

For the priority areas tentative budget requirements have been estimated. Considering the larger share of co-funding needed for GEF projects, appropriate and robust co-funding sources and approaches are needed. Therefore, approaches and strategies for funding and co-funding are compiled in Section 3.6.

# Table of Contents

| Abbreviation | Dutch name | English name |
| --- | --- | --- |
| 3R | | Reduce, Reuse, Recycling |
| ABS | Algemeen Bureau voor de Statistieken | General Bureau of Statistics |
| ACT | | Artemisinin-based Combination Therapy |
| ADEKUS | Anton de Kom Universiteit van Suriname | Anton de Kom University of Suriname |
| ADRON | Anne van Dijk Rijst Onderzoekscentrum Nickerie | Anne van Dijk Rice Research Centre Nickerie |
| AGVIS | Agrarische Gezondheid en Voedselveiligheid Instituut Suriname | Agricultural Health and Food Safety Institute |
| ALCOA | | Suriname Aluminium Company L.L.C |
| ASFA | Associatie van Surinaamse Fabrikanten | Association of Surinamese Manufacturers |
| AST | | Above-ground storage tank |
| ATM | Ministerie van Arbeid, Technologische Ontwikkeling en Milieu | Ministry of Labour, Technological Development and Environment |
| BAT | | Best available techniques |
| BC | Bazel Conventie inzake de beheersing van de grensoverschrijdende overbrenging van gevaarlijke afvalstoffen en de verwijdering ervan | Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal |
| BCRC-Caribbean | | Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region |
| BEP | | Best environmental practices |
| BFRs | | Brominated Flame Retardants |
| BOG | Bureau voor Openbare Gezondheidzorg | Bureau for Public Health |
| BREFs | | BAT Reference documents |
| BTI | | *Bacillus thuringiensis israelensis* |
| CARICOM | Caribische Gemeenschap | Caribbean Community |
| CBL | Centraal Bureau Luchtkartering | Central Bureau for Air Mapping |
| CETESB | | Companhia Ambiental do Estado de São Paulo (Stockholm regional centre Brazil) |
| CiP | | Chemicals in Products |
| COP | Conferentie van de Partijen | Conference of the Parties |
| c-DecaBDE | | Commercial decabromodiphenyl ether |
| c-OctaBDE | | Commercial octabromodiphenyl ether |
| c-PentaBDE | | Commercial pentabromodiphenyl ether |

| Abbreviation | Dutch name | English name |
|---|---|---|
| CM | Coördinatie Milieu | Coordination Environment |
| CRTs | | Cathode Ray Tubes |
| DBK | Dienst Bodemkartering | Soil Mapping Service |
| DCs | Districtscommissarisen | District Commissioners |
| DDE | | Dichlorodiphenyldichloroethylene |
| DDT | | 1,1,1-trichloro-2,2-bis(4chlorophenyl)ethane |
| DEF | Ministerie van Defensie | Ministry of Defence |
| DEV | Dienst Electriciteit Voorziening | Electricity Supply Service |
| DNA | De Nationale Assemblee | The National Assembly |
| DWV | Dienst Water Voorziening | Water Supply Department |
| EIA | Milieu Effect Rapportage | Environmental Impact Assessment |
| ELVs | | End-of-life vehicles |
| EPR | | Extended Producer Responsibility |
| EPS | | Expanded polystyrene |
| ERP | | Emergency Response Plan |
| ESM | | Environmentally Sound Management |
| EU | Europese Unie | European Union |
| E-waste | | Electronic waste |
| FAI | | The Fruit Farm Group branch in Suriname |
| FAO | Voedsel- en Landbouw Organisatie van de Verenigde Naties | United Nations Food and Agricultural Organization |
| FIN | Ministerie van Financiën | Ministry of Finance |
| FP | | Focal Point |
| G&SC | | Green & Sustainable Chemistry |
| GAP | | Good Agricultural Practices |
| GDP | Bruto Binnenlands Product | Gross Domestic Product |
| GEF | | Global Environment Facility |
| GHG | | Greenhouse Gas |
| GHS | | Global Harmonized System |
| GIS | Geografische Informatie Systemen | Geographic Information Systems |
| GLIS | | Land Registration and Information System |
| GMD | Geologisch Mijnbouwkundige Dienst | Geological Mining Service |
| GPS | Geografische Positionering Systeem | Geographic Positioning System |

| Abbreviation | Dutch name | English name |
|---|---|---|
| GWP | | Global Warming Potential |
| HBB | | Hexabromobiphenyl |
| HBCD | | Hexabromocyclododecane |
| HCB | | Hexachlorobenzene |
| HCBD | | Hexachlorobutadiene |
| HCH | | Hexachlorocyclohexane |
| HeptaBDE | | Heptabromodiphenyl ethers |
| HexaBDE | | Hexabromodiphenyl ethers |
| HFCs | | Hydrofluorocarbons |
| HHPs | | Highly hazardous pesticides |
| HI&T | Ministerie van Handel, Commerce & Toerisme | Ministry of Trade and Commerce and Tourism |
| HIPS | | High Impact Polystyrene |
| HpCDD | | Heptachlorodibenzo-p-dioxin |
| HS | | Harmonized System |
| HxCDD | | Hexachlorodibenzo-p-dioxin |
| ICC | | Intermediate Collection Centre |
| ICCM | | Integrated Crop Management |
| ICCO | | Interchurch Organization |
| IHPA | Internationaal HCH & Pesticide Associatie | International HCH & Pesticides Association |
| IPPC | | Integrated Pollution Prevention and Control |
| IPM | | Integrated Pest Management |
| IRS | | Indoor residual spraying |
| IVM | | Integrated Vector Management |
| JP | Ministerie van Justitie en Politie | Ministry of Justice and Police |
| KAP | | Knowledge, Attitude and Practices |
| LB | | Ministry of Labour |
| LHB | Naamloze Vennootschap Luchthavenbeheer | Limited Liability Airport Management |
| LLIN | | Long-lasting insecticide-treated mosquito nets |
| LVV | Ministerie van Landbouw, Veeteelt en Visserij | Ministry of Agriculture, Animal Husbandry and Fisheries |
| MEAs | | Multilateral Environmental Agreements |

| Abbreviation | Dutch name | English name |
|---|---|---|
| MOU | | Memorandum of Understanding |
| MSDS | | Material safety data sheet |
| N-EtFOSA | | N-ethylperfluorooctansulphonamid |
| NAP | Nationaal Actieplan | National Action Plan |
| NCCR | Nationale Cöordinatie Commissie Rampenbeheersing | National Coordination Commission for Disaster Management |
| NCPS | Nationaal Chemicaliën Profiel Suriname | National Chemical Profile Suriname |
| NGO | Niet Gouvernementele Organisatie | Non-Governmental Organization |
| NH | Ministerie van Natuurlijke Hulpbronnen | Ministry of Natural Resources |
| NIMOS | Nationaal Instituut voor Milieu en Ontwikkeling in Suriname | National Institute for Environment and Development in Suriname |
| NIP | Nationaal Implementatie Plan | National Implementation Plan |
| NPC | Nationaal Project Coördinator | National Project Coordinator |
| N.V.EBS | Naamloze Vennootschap Energie Bedrijven Suriname | Limited Liability Energy Company of Suriname |
| OCDD | | Octachlorodibenzodioxin |
| ODS | | Ozone Depleting Substances |
| OPs | | Obsolete Pesticides |
| OWC | Ministerie van Onderwijs, Wetenschap en Cultuur | Ministry of Education, Science and Culture |
| OWTC | Ministerie van Openbare Werken, Transport en Communicatie | Ministry of Public Works, Transport and Communication |
| PAHs | | Polyaromatic hydrocarbons |
| PBDEs | | Polybrominated diphenyl ethers |
| PBTs | | Persistent, Bioaccumulative & Toxic Chemicals |
| PCBs | | Polychlorinated biphenyls |
| PCDDs | | Polychlorinated dibenzo-para-dioxins |
| PCDFs | | Polychlorinated dibenzofurans |
| PCNs | | Polychlorinated naphthalenes |
| PCP | | Pentachlorophenol |
| PE | | Polyethylene |
| PeCB | | Pentachlorobenzene |
| PentaBDE | | Pentabromodiphenyl ethers |
| PFOA | | Perfluorooctanoic acid |
| PFAS | | Per & polyfluorinated alkylated substances |

| Abbreviation | Dutch name | English name |
|---|---|---|
| PFHxS | | Perfluorohexanesulfonic acid |
| PFOS | | Perfluorooctane sulfuric acid |
| PFOSF | | Perfluorooctanesulfonyl fluoride |
| PIC | | Prior Informed Consent |
| PM | | Particulate Matter |
| POPs | Persistente Organische Vervuilers | Persistent Organic Pollutants |
| POPRC | | POP Review Committee |
| PPE | Persoonlijke Beschermingsmiddelen | Personal Protective Equipment |
| PPP | | Polluter Pays Principle |
| PRTR | | Pollution Release Transfer Register |
| PSMS | | Pesticide Stock Management System |
| PVC | | Polyvinyl chloride |
| PWC | | Project Working Committee |
| QA/QC | | Quality Assurance/ Quality Control |
| RC | Rotterdam Conventie inzake de procedure met betrekking tot voorafgaande geïnformeerde toestemming ten aanzien van bepaalde gevaarlijke stoffen en pesticiden in de internationale handel | Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade |
| ReComSur | | Recycling Company Suriname |
| RGB | Ministerie van Ruimtelijke ordening, Grond- en Bosbeheer | Ministry of Physical Planning, Land and Forest Management |
| RO | Ministerie van Regionale Ontwikkeling | Ministry of Regional Development |
| SAICM | | Strategic Approach to International Chemical Management |
| SC | Stockholm Verdrag inzake Persistente Organische Vervuilers | Stockholm Convention on Persistent Organic Pollutants |
| SCCPs | | Short-chain chlorinated paraffins |
| SCPs | | Sustainable consumption and production |
| SDGs | | Sustainable Development Goals |
| SEA | | Socio-economic Assessment |
| SGP | | Small Grants Programme |
| SSB | Surinaams Standaarden Bureau | Suriname Bureau of Standards |
| STEPS | | Foundation for Ecological Products Suriname |
| SURALCO | | Suriname Aluminium Company |

| Abbreviation | Dutch name | English name |
|---|---|---|
| SWM | N.V. Surinaamse Waterleiding Maatschappij | Limited Liability Surinamese Water Company |
| TDI | | Tolerable daily intake |
| TEQ | | Toxicity Equivalent |
| Tetra BDE | | Tetrabromodiphenyl ether |
| TPH | | Total petroleum hydrocarbons |
| TV | | Television |
| UNEP | Verenigde Naties Milieu Programma | United Nations Environment Programme |
| UNIDO | | United Nations Industrial Development Organization |
| UPOPs | | Unintentional produced POPs |
| US(A) | | United States of America |
| UST | | Underground Storage Tank |
| UWI | | University of the West Indies |
| VG | Ministerie van Volksgezondheid | Ministry of Public Health |
| VKI | Viskeuringsinstituut | Fish Inspection Institute |
| VOV | Vuil Ophaal en -Verwerking | Garbage Disposal and Processing |
| VSB | Vereniging Surinaams Bedrijfsleven | Surinamese Business Association |
| WASPAR | Wasserij Particuliere Ziekenhuizen | Laundry Service Private Hospitals |
| WEEE | | Waste Electrical and Electronic Equipment |
| WHO | Wereldgezondheidsorganisatie | World Health Organization |
| WM | | Waste Management |
| WP | | Wettable Powder Formulation |
| XPS | | Extruded polystyrene |

# 1. Introduction

**Chapter 1 outlines the purpose and structure of the National Implementation Plan (NIP), including a summary of the Stockholm Convention (SC), its aims and its obligations. It also describes the mechanism used to develop the NIP and the stakeholder consultation process. A summary of the Persistent Organic Pollutants (POPs) issue provides the context and background outlining the chemicals, their uses, and the problems they cause.**

## 1.1. Stockholm Convention

The Stockholm Convention on Persistent Organic Pollutants was adopted on 22 May 2001 and entered into force on 17 May 2004. It imposes a worldwide ban on the production and trade in pesticides (Aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, and toxaphene), two industrial chemicals (Hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs)) and two by-products of incineration processes, polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), from 2004 onwards.

In 2009, the COP by decisions SC-4/10 to SC-4/18, adopted amendments to Annexes A (elimination), B (restriction), and C (unintentional production) to list nine additional chemicals as POPs. These chemicals are the following pesticides: chlordecone, alpha hexachlorocyclohexane (HCH), beta HCH, lindane, pentachlorobenzene (PeCB); industrial chemicals: hexabromobiphenyl (HBB), hexabromodiphenyl ether (hexaBDE) and heptabromodiphenyl ether (heptaBDE), PeCB, perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride, tetrabromodiphenyl ether (tetraBDE and pentabromodiphenyl ether (pentaBDE); and by-products: alpha-HCH, beta-HCH and pentachlorobenzene. In 2011, the COP through its decision SC-5/3, adopted an amendment to Annex A (elimination) listing technical endosulfan and its related isomers. In 2013, the COP in its decision SC-6/13, adopted an amendment to Annex A (elimination) by including hexabromocyclododecane (HBCD). In 2015, through its decisions SC-7/12, SC-7/13 and SC-7/14, the COP adopted amendments to Annex A (elimination) and C (unintended production) listing hexachlorobutadiene (HCBD) and pentachlorophenol (PCP) and its salts and esters in Annex A, and polychlorinated naphthalenes (PCNs) in Annex A and C. In 2017, through its decisions SC-8/10, SC-8/11 and SC-8/12, the COP adopted amendments to Annex A (elimination) and C (unintentional production) by adding decabromodiphenyl ether (commercial mixture, c-DecaBDE) and short-chain chlorinated paraffins (SCCPs) in Annex A. HCBD was additionally listed in Annex C. The POPs listed in 2017 are not assessed in this updated NIP. However, activities are proposed in the action plan to address these POPs in future.

Table 1 presents an overview of the POPs listed in Annex A, B and C of the SC as of 2017.

*Table 1. List of POPs in Annex A, B and C of the SC*

| **Annex A (Elimination)** | **Annex B (Restriction)** | **Annex C (Unintentional Production)** |
|---|---|---|
| Parties must take measures to eliminate the production and use of the chemicals listed under Annex A. Specific exemptions for use or production are listed in the Annex and apply only to Parties that register for them. | Parties must take measures to restrict the production and use of the chemicals listed under Annex B considering any applicable acceptable purposes and/or specific exemptions listed in the Annex. | Parties must take measures to reduce the unintentional releases of chemicals listed under Annex C with the goal of continuing minimisation and, where feasible, ultimate elimination. |
| Aldrin<br>Chlordane<br>Chlordecone<br>Decabromodiphenyl ether (commercial mixture, c-decaBDE),<br>Dieldrin<br>Endrin<br>Heptachlor<br>Hexabromobiphenyl (HBB)<br>Hexabromodiphenyl ether and heptabromodiphenyl ether<br>Hexabromocyclododecane (HBCD)<br>Hexachlorobenzene (HCB)<br>Hexachlorobutadiene (HCBD)<br>Alpha hexachlorocyclohexane<br>Beta hexachlorocyclohexane<br>Lindane<br>Mirex<br>Pentachlorobenzene (PeCB)<br>Pentachlorophenol and its salts and esters (PCP, its salts and esters)<br>Polychlorinated biphenyls (PCBs)<br>Polychlorinated naphthalenes (PCNs)<br>Short-chain chlorinated paraffins (SCCPs)<br>Tetrabromodiphenyl ether and pentabromodiphenyl ether<br>Toxaphene<br>Technical Endosulfan and its related isomers | DDT<br>Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (PFOS, its salts and PFOS-F) | Polychlorinated dibenzo-p-dioxins<br>(PCDD)<br>Polychlorinated dibenzofurans<br>(PCDF)<br>Hexachlorobenzene (HCB)<br>Pentachlorobenzene (PeCB)<br>Polychlorinated biphenyls (PCBs)<br>Polychlorinated naphthalenes (PCNs)<br>Hexachlorobutadiene (HCBD) |

In the case of some POPs listed in Annexes A and B, the COP has adopted acceptable purposes and/or specific exemptions as presented in Table 2 below.

*Table 2. Acceptable purposes and/or specific exemptions for POPs listed in the SC*

| Chemical | Annex | Specific exemptions / Acceptable purposes | Related document (decision) |
|---|---|---|---|
| Decabromodiphenyl ether (commercial mixture, c-DecaBDE) | A | **Production:** As allowed for the parties listed in the Register<br>**Use:** Vehicles, aircraft, textile, additives in plastic housings etc., polyurethane foam for building insulation, in accordance with Part IX of Annex A | Not yet available |
| Hexabromocyclododecane | A | **Production:** As allowed by the parties listed in the Register of specific exemptions.<br>**Use:** Expanded polystyrene and extruded polystyrene in buildings in accordance with the provisions of part VII of Annex A | SC-6/13 |
| Hexabromodiphenyl ether and heptabromodiphenyl ether (homologues of commercial octabromodiphenyl ether) | A | **Production:** None<br>**Use:** Articles in accordance with the provisions of Part IV of Annex A | SC-4/14 |
| Lindane | A | **Production:** None<br>**Use:** Human health pharmaceutical for control of head lice and scabies as second line treatment | SC-4/15 |
| Pentachlorophenol and its salts and esters | A | **Production:** As allowed for the parties listed in the Register in accordance with the provisions of part VIII of Annex A<br>**Use:** Pentachlorophenol for utility poles and cross-arms in accordance with the provisions of part VIII of Annex A | SC-7/13 |
| Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride | B | **Production:** For the use below<br>**Use:** Acceptable purposes and specific exemptions in accordance with Part III of Annex B | SC-4/17 |
| Polychlorinated naphthalenes | A and C | **Production:** For the use below<br>**Use:** Production of polyfluorinated naphthalenes, including octafluoronaphthalene | SC-7/14 |
| Short-chain chlorinated paraffins (SCCPs) | A | **Production:** As allowed for the parties listed in the Register<br>**Use:** Additives in transmission belts, rubber conveyor belts, leather, lubricant additives, tubes for outdoor decoration bulbs, paints, adhesives, metal processing, plasticizers | Not yet available |

| Chemical | Annex | Specific exemptions / Acceptable purposes | Related document (decision) |
|---|---|---|---|
| Technical endosulfan and its related isomers | A | **Production:** As allowed for the parties listed in the Register of specific exemptions **Use:** Crop-pest complexes as listed in accordance with the provisions of part VI of Annex A | SC-5/3 |
| Tetrabromodiphenyl ether and pentabromodiphenyl ether (homologues of commercial pentabromodiphenyl ether) | A | **Production:** None **Use:** Articles in accordance with the provisions of Part V of Annex A | SC-4/18 |
| DDT (1,1,1-trichloro-2,2-bis (4-chlorophenyl) ethane) | B | **Production:** Use of vector control against diseases in accordance with Part II of this Annex **Use:** Use of vector control against diseases in accordance with Part II of this Annex | SC-5/6 |

*Source: Stockholm Convention website*

These substances are designated as POPs and are toxic, persistent and can be transported over great distances through the air or water. POPs can cause adverse effects on the environment and health because they accumulate in organisms. This can result in cancer, sterility and disruption of the immune system. Parties to the SC are obligated to develop, within two years of the ratification, a NIP describing the national situation with respect to the substances listed in the Convention and the strategies developed to implement their obligations under the SC. The SC also requires all parties to develop an Action Plan. In this National Action Plan (NAP) the parties must specify what strategies they would develop to meet the obligations of the SC.

Suriname signed the SC in May 2002 and ratified it on 20 September 2011. The Convention entered into force on 19 December 2011. The focal point (FP) of SC resides at Coordination Environment (CM) in the Cabinet of the President.

In 2011, the GEF approved financial support for the implementation of the project "Initial Assistance to Enable Suriname to fulfil its obligations under the Stockholm Convention on Persistent Organic Pollutants", where the first NIP was developed and completed.

In 2015, GEF approved financial support for the implementation of the regional project, "Development and Implementation of a Sustainable Management Mechanism for POPs in the Caribbean" which is an integrated project for the Caribbean region. UNIDO is the implementing agency and the BCRC-Caribbean is the executing agency in this project.

The project aims to build both institutional and human resource capacity to deal with the impact of POPs and unintentionally produced POPs (UPOPs) in eight (8) of the Caribbean countries who are Parties to the SC, including Suriname. The project's first component is to deliver updated NIPs for the participating countries. In Suriname, the Project Working Committee (PWC) is executing this project.

## 1.2. Goals and Provision of the Stockholm Convention

Article 7 of the SC requires that each Party must develop, and endeavour to put into practice, a plan setting out how it will implement its obligations under the SC. The plan must be transmitted to the COP within two years of the date on which the Party ratified the Convention.

The goals of the NIP are:

I to set out the actions that Suriname has undertaken regarding the reduction of the presence of POPs;

II. to propose actions that Suriname will undertake to manage and eliminate POPs from entering the environment considering the Convention;

III. to inform the COP and Surinamese community about national initiatives and projects designed to meet the requirements of the SC.

The NIP describes how Suriname will fulfil its obligations under the SC to eliminate or reduce POPs-releases to the environment and carry out environmentally-sound management of stockpiles of POPs-contaminated wastes and contaminated sites that pose high risks for human health and the environment, with a regional perspective.

The outcomes from the implementation of the NIP will include:

I. the protection of public health from the effects of POPs;

II. a structured POPs management;

III. capacity building to maintain and monitor the quality of the environment; and

IV. meeting the obligations under the SC.

The NIP will be updated as necessary to reflect decisions made by the Government and COP. Such decisions include amendments to the SC or its annexes, including the addition of chemicals to Annexes A, B or C, or adoption of guidance or guidelines.

## 1.3. NIP Development Methodology

As previously stated, the SC FP resides at CM and CM coordinates all activities regarding the implementation of this convention, inclusive of the NIP.

There is a PWC established under the GEF # 5558 Regional POPs Project (2015-2020) with the principle function and duty to oversee the project. The PWC represents the following organisations:

1. CM,
2. LVV,
3. National Institute of Environment and Development in Suriname (NIMOS),
4. Ministry of Public Works, Transport and Communication (OWTC),
5. Ministry of Trade, Commerce and Tourism (HI&T),
6. Bureau for Public Health (BOG) of the Ministry of Public Health (VG)
7. Anton de Kom University of Suriname (ADEKUS).

**Activities that have been conducted for updating the NIP were:**

1. *Establishing and strengthening coordinating mechanisms* through the SC FP and the PWC to guide the process leading to the formulation and approval of the NIP. Considering the GEF #5558 project, a National Project Coordinator (NPC) was hired who, in close coordination with the PWC, BCRC-Caribbean and UNIDO, assisted the project partners in implementing the project activities and outputs;
2. *Assessment of national, legal, infrastructure and institutional capacity to manage new POPs have been executed.* Staff got acquainted with the updated United Nations Environment Programme (UNEP) toolkit to elaborate inventories of unintentional POPs sources and loads;

3. *Establishing of basic and newly listed POPs inventories.* To ensure a valid updated NIP, the development of the inventories of the new POPs was conducted within this project. The baseline inventory of sources and loads of unintentional POPs in Suriname have been updated to develop an action plan for UPOPs sources in the NIP, as well as to identify the capacity building needs to reduce or eliminate POPs emissions. Elaboration of inventories for newly listed industrial POPs have been developed including the first fluorinated POPs (PFOS and related substances), as well as listed brominated POPs (PBDEs and HBCD);
4. *Monitoring and risk assessment capacity*. A review of the capacity needs and means to monitor POPs and other chemical pollution in the environment and assessment of human and ecosystem exposure has been conducted. Some monitoring activities have been initiated and contact to the regional SC Centre in Brazil and national institute for food safety in the Netherlands (RIKILT) established;
5. *National Priority assessment and objective-setting to accelerate reduction and elimination of new POPs* to support the implementation of the SC;
6. *Development of action plans* for implementation of the reviewed and updated NIPs and their submissions;
7. *Training*. Suriname participated in different workshops and activities at the regional level that were aimed at raising awareness on the obligations to the SC and help build or strengthen human capacity to implement the Convention at a national level. A national training workshop on updating the NIP has been conducted concerning the different areas covered by the SC such as the newly listed POPs (to be addressed in the NIP update), control and effects of unintentional POPs releases, PCB, pesticides, legislation related to controlled substances, contaminated sites, etc. International expertise is engaged to conduct training to improve the local staff's capacity;

The NIP is consistent with the GEF's initial guidelines for enabling activities for the SC, and the interim guidance for developing a NIP (UNEP and The World Bank Group), including strategies required under articles 5 and 6 of the Convention.

## 1.4. NIP structure

The NIP comprises of the following three chapters:

- Chapter 1 gives an introduction about the SC and its goals and provisions. It describes the development and the structure of the NIP. Overall, chapter 1 provides an overview of the aims and goals of the NIP, as well as the process for the development of the NIP;
- Chapter 2 outlines Suriname's demographic, political and economic status. It elaborates on the environmental situation and the current status of the institutional, policy and regulatory framework. This chapter also presents the results of the assessment of POPs, focusing on the import and export, production, current and future use, registration, release, storage, disposal, and the potential impact. The POPs mentioned in this chapter are: POPs pesticides, PCBs, DDT, new POPs and unintentional POPs. The existing monitoring programmes, and the information-exchange and awareness are also described in this chapter. Overall, it gives basic information on Suriname's status regarding the management of POPs;
- Chapter 3 presents an overview of recommended activities, strategies, and action plans. In addition, there is a budget related to the activities of the action plan;

The appendices contain information on restricted pesticides and on pesticide-contaminated sites.

## 1.5. Further considerations

In addressing POPs management in Suriname, a socio-economic assessment (1.1.5) and an assessment on gender policy (1.5.2) were conducted.

### *1.5.1. Socio-Economic Assessment*

A growing body of data on the links between pollution and health demonstrates the negative impacts, including contaminants from indoor exposure (e.g. heating/cooking, chemicals used indoor and chemicals in consumer products), outdoor air pollution, pesticide use and contaminated sites with highest impact on health in developing countries with an estimated 12 to 14 million deaths per year[5,6,7,] Open waste burning[8,9] and open biomass burning[10] contribute to the overall air pollution including particulate matter (PM10; PM 2.5). Dioxins/UPOPs, PAHs, and heavy metals together with plastics have a relevant contribution to open burning in urban area as fuel sources. Endocrine disrupting chemicals including POPs and their effects are main contributors to health-associated costs in industrial countries[11,12,13]. A recent assessment suggests that environmental chemical exposures contribute a cost that may exceed 10 % of the global domestic product.[14] Therefore, a more critical assessment of the burden of pollution from chemicals, industrial and other releases is needed.

References to socio-economic assessment can be found throughout the text of the SC[15]. These references indicate the importance of a socio-economic assessment when implementing the obligations under the Convention and when developing the updated NIP. GEF 2020 strategy suggests aligning global environmental objectives with priorities of national and global socio-economic development.

Annex F gives information on socio-economic considerations of SC and provides an indicative list of items to be taken into consideration by Parties when undertaking an evaluation regarding possible control measures for chemicals being considered for inclusion into the Convention. The preamble to Annex F states that: “An evaluation should be undertaken regarding possible control measures for chemicals under consideration for inclusion in this Convention, encompassing the full range of options, including management and elimination. For this purpose, relevant information should be provided relating to socio-

5 Prüss-Ustün A, Wolf A, Corvalán C, Bos R, Neira M (2016) Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. WHO report. ISBN 978 92 4 156519 6

6 The Lancet Commission on pollution and health. http://www.thelancet.com/commissions/pollution-and-health

7 Other studies see these diseases as the major reason for death (Institute for Health Metrix & Evaluation; http://www.healthdata.org/gbd/publications)

8 Wiedinmyer C, Yokelson RJ, Gullett BK (2014) Global emissions of trace gases, particulate matter, and hazardous air pollutants from open burning of domestic waste. Environ Sci Technol. 48(16), 9523-9530.

9 Kumar S, Aggarwal SG, Gupta PK, Kawamura K (2015) Investigation of the tracers for plastic-enriched waste burning aerosols. Atmospheric Environment 108, 49-58.

10 Yadav IC, Linthoingambi Devi N, Li J, Syed JH, Zhang G, Watanabe H. (2017) Biomass burning in Indo-China peninsula and its impacts on regional air quality and global climate change-a review Environ Pollut. 227, 414-427.

11 UNEP & WHO (2013) State of the Science of Endocrine Disrupting Chemicals – 2012.

12 Attina TM, Hauser R, et al. (2016) Exposure to endocrine-disrupting chemicals in the USA: a population-based disease burden and cost analysis. Lancet Diabetes Endocrinol. 4(12):996-1003.

13 Trasande L, Zoeller T et al. (2015) Estimating Burden and Disease Costs of Exposure to Endocrine-Disrupting Chemicals in the European Union. J Clin Endocrinol Metab. 100(4), 1245–1255.

14 Grandjean P., Bellanger M (201) Calculation of the disease burden associated with environmental chemical exposures: application of toxicological information in health economic estimation. Environmental Health (2017) 16:123.

15 UNEP (2007) Draft guidance on socio-economic assessment for national implementation plan development and implementation under the Stockholm Convention. UNEP/POPS/COP.3/INF/8.

economic considerations associated with possible control measures to enable a decision to be taken by the COP".

The COP in its decision SC-1/12 requested that the SC Secretariat, in collaboration with other relevant organisations and subject to resource availability, to develop among others, additional guidance on social and economic assessment, and in so doing, consider the particular circumstances of developing countries and countries with economies in transition. In response to that request, the Secretariat developed the draft guidance on socio-economic assessment for NIP development and implementation under the Convention. According to the guidance, the Socio-economic Assessment (SEA) is a systematic appraisal of the potential social impacts of economic or other activities such as the management of POPs in all sectors of society (including local communities and groups, civil society, private sector and Government). It is a means of analysing and managing the intended and unintended social impacts, both positive and negative, of planned interventions (policies, programs, plans and projects) and any social change processes invoked by those interventions. Social impacts are the changes to individuals and communities that come about due to actions that alter the day-to-day way in which people live, work, play, relate to one another, organise to meet their needs and generally cope as members of society.

In the context of managing POPs, social and economic impacts might include:

- contamination of air, water and soil and threat to food safety and drinking water safety;
- degradation of ecosystem services[16];
- vulnerability arising from exposure to POPs;
- deterioration or improvement in health[8];
- loss or improvement in livelihoods;
- changes in cost of living;
- cost of contaminated site management and remediation;
- changes in employment, income and workplace protection;
- changes in levels of equity of wealth distribution;
- opportunities for enterprise development (including Small and Medium Enterprises);
- changes in demand for public services, such as health and education.

The Socio-economic Assessment has assisted and will assist in taking actions that are appropriate and effective. Socio-economic Assessment provides a basis for minimising the negative impact on the population and improving equitable outcomes for the most vulnerable groups. However, the Socio-economic Assessment lacks information on external costs. The unknown external costs can give rise to biased decisions and thus there is need to take precautionary approaches. The human resource capacity on Socio-economic Assessment in Suriname is rather limited and needs to be improved throughout the implementation of updated NIP.

Socio-economic Assessment can help at any phase of development of the NIP and during its implementation. If priorities have already been set in Phase I to Phase III of the NIP, then a socio-economic assessment can be used to gain insight into the impacts of mitigation measures already decided. In this case, a brief investigation may be conducted for Phase IV. The results will assist in developing NIP communication strategies and rule out the worst excesses of inequitable impact.

For Suriname, the following socio-economic considerations and cost benefit analysis are highlighted as relevant. These key areas are considered as a framework for implementation without trying to apply usual socio-economic calculations requiring sophisticated single stakeholder assessments and often not leading

[16] Millenium-Ecosystem Assessment (2005) Ecosystems and Human Well-being: General Synthesis. http://www.maweb.org/documents/document.356.aspx.pdf

to a practical outcome for developing countries where such information is not available. At the same time these areas are partly national priorities for Sustainable Development[17]:

a) Food and water safety (including POPs exposure of population)
b) Exposure of vulnerable and highly exposed groups
c) Management of chemicals and waste
d) Cost of destruction and end-of-life management and treatment of POPs and other hazardous waste
e) Cost of contaminated soil and site remediation

The socio-economic considerations mentioned above are highlighted as most relevant. Improper chemical and waste management play a relevant role. Another pollution source in Suriname is the intensive scale of legal and illegal gold extraction activities using mercury.

### *1.5.2. Gender policy in NIP development and implementation*

Men, women, and children are exposed to different kinds of chemicals in varying concentrations in their daily lives, thus efforts to ensure sound management of chemicals, including POPs have important gender dimensions. Biological factors, notably size and physiological differences between women and men and between adults and children, influence susceptibility to health effects from exposure to toxic chemicals. Social factors, primarily gender-determined occupational roles, also have an impact on the level and frequency of exposure to toxic chemicals, the types of chemicals encountered, and the resulting impacts on human health.[18.]

It is important that these gender dimensions are reflected at both site and policy level interventions for sound chemical management. The gender analysis is used to identify, understand, and describe gender differences and the impact of gender inequalities in a sector or program at the country level. Gender analysis is a required element of strategic planning and is the foundation on which gender integration is built. Gender analysis examines the different but interdependent roles of men and women and the relations between the sexes. It also involves an examination of the rights and opportunities of men and women, power relations, and access to and control over resources. Gender analysis identifies disparities, investigates why such disparities exist, determines whether they are detrimental, and if so, looks at how they can be remedied[19].

Consistent with the GEF Policy on gender mainstreaming and the GEF-6 approach on gender mainstreaming, GEF projects funded under this strategy will not only acknowledge gender differences within their design but determine what actions are required to promote both women's and men's roles in chemical management, disproportionate chemical exposure and vulnerability, as well as sustainable alternatives.

[17]Ministry of Foreign Affairs (2013) REPUBLIC OF SURINAME NATIONAL REPORT in preparation of THE THIRD INTERNATIONAL CONFERENCE ON SMALL ISLAND DEVELOPING STATES (SIDS) Paramaribo, July 2013

[18] United Nation Development Programme, Gender Mainstreaming. A Key Driver of Development in Environment and Energy, Energy and Environment Practice. Gender Mainstreaming Guidance Series;

[19] United States Agency for International Development (2011), Tips for Conducting a Gender Analysis at the Activity and Project Level. Additional Help for ADS Chapter 201;

# 2. Country baseline

**Section 2 provides basic background information relevant to the NIP. It describes the current situation and state of knowledge in the country about POPs and the status of institutional and other capacity to address the problem.**

## 2.1. Country profile

A brief country profile is given to place the NIP strategies and action plans in a country-specific context. It summarises information on geography and population, membership in regional and sub-regional organisations, the country's political and economic profile, profiles of potentially important economic sectors in the context of the POPs issue, and overall environmental conditions and priorities in the country.

### *2.1.1. Geography and population*

The Republic of Suriname has a land mass of 163,820 sq. km[20] and is located on the north-eastern part of South America between 2-6$^0$ N and 54-58$^0$ W[2]. Suriname borders the Atlantic Ocean to the north, Brazil to the South, Guyana to the West and the French Oversees Department of La Guyane (also named French Guiana) to the East. The land area can be divided into a swampy coastal plain, a central plateau region containing broad savannahs and swamp forest, and a mountainous region densely forested with tropical vegetation, to the south.

The country has a typical tropical climate with two rainy and two dry seasons, an average daily temperature of 27 $^0$C and an annual average rainfall varying from 1,900 mm along the coast to 2,700 mm in the middle of the country.[21] Suriname is divided into ten districts: Paramaribo, Brokopondo, Commewijne, Coronie, Marowijne, Nickerie, Para, Saramacca, Sipaliwini, and Wanica. A District Commissioner (DC) heads each district.

Suriname has a small, yet culturally diverse population of 575,763 people. Approximately 90 % of the population live along the coast of Suriname. The population is characterised by an ethnic diversity of the following: Hindustani, 27 %; Maroons, 22 %; Creoles, 16 %; Javanese, 14 %; Mestizos, 13 %; and Amerindians, 4 %.[4]

Population density (people per square km) in the urban and rural areas, as well as the interior of Suriname, is as follows:

- Population density in the urban areas: Paramaribo: 1,323.8 people per $km^2$; Wanica: 266.9 people per $km^2$;
- Population density in the rural areas: Nickerie: 6.4 people per $km^2$; Coronie: 0.9 people per $km^2$; Saramacca: 4.8 people per $km^2$; Commewijne: 13.4 people per $km^2$; Para: 4.6 people per $km^2$.
- Population density in the interior: Marowijne: 4.0 people per $km^2$; Brokopondo: 2.2 people per $km^2$; Sipaliwini: 0.3 people per $km^2$.

The birth rate per woman is 2.34[22] and the life expectancy in 2015 is 71.29 years[23]. Suriname has a literacy rate of 89.6 %[24]. The median age of the population in 2015 is 28.4 years, while 357,200 people are in the age group of 15-59 (2016)[25].

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[20] ATM; Suriname 3rd National Report to the Convention on Biological Diversity; September 2009.

[21] ABS, 2010 & ABS, 2005.

[22] ABS Data of 2003

[23] PAHO Health Data

[24] www.indexmundi.com/g/g.aspx?c=ns&v=39

[25] Suriname Census 2004 Vol. 2, General Bureau of Statistics

The official language is Dutch, but more than 16 other languages and dialects are spoken, including Sranan Tongo (the national lingua franca), and languages specific to the various ethnic groups.


*Figure 1. Map of Suriname*

## *2.1.2. Political profile*

In 1975, Suriname gained independence from the Netherlands. The Republic of Suriname is a constitutional democracy based on the 1987 constitution with a three-way doctrine. The legislative branch of Government consists of a 51-member National Assembly (DNA), elected for a 5-year term. The last election was held May 2015. The executive branch is headed by the President, who is elected by a two-thirds majority of the DNA or, failing that, by a majority of the 'People's Assembly' for a 5-year term. The People's Assembly is formed from all DNA delegates, regional and municipal representatives who are elected by popular vote in the most recent national election. A simple majority of the DNA or People's Assembly is required to elect a Vice President. He or she is usually elected at the same time as the President, for a 5-year term. As Head of Government, the President appoints a cabinet of ministers and chairs the State Council. The judiciary branch is comprised of the Court of Justice and the Supreme Court. The Supreme Court supervises the magistrate courts. The President in consultation with the DNA, the State Council, and the National Order of Private Attorneys appoints members for life.

### 2.1.3. *Profiles of economic sector*

Mining, agricultural production, manufacturing, wholesale and retail contribute to Suriname's Gross Domestic Product (GDP). However, the largest contributors are mining and quarry operations, with exports of gold, and oil accounting for about 85 % of export trade and 25 % of Government revenues. In the manufacturing sector, crude oil refining are the largest contributors to GDP[26].

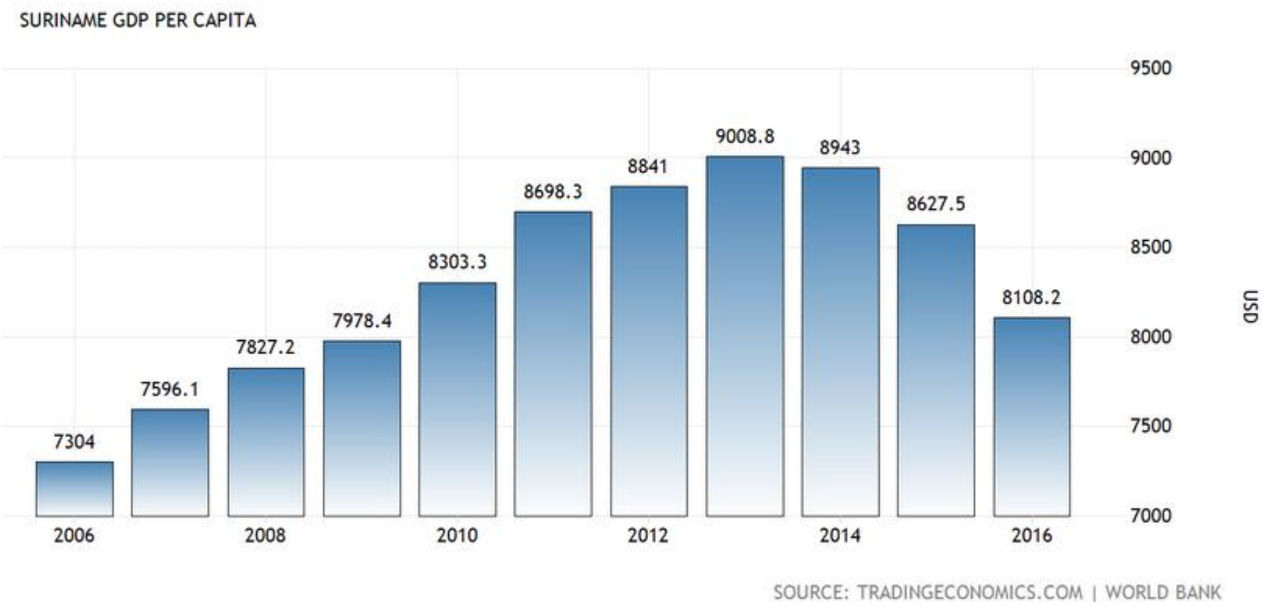


*Figure 2. GDP per capita for Suriname (2006 – 2016)*

*Table 3. The various contributions of the industrial sectors to the GDP[27]*

| Industries of origin | Contribution in 2016 (in 1000 USD) |
|---|---|
| Manufacturing | 241,252 |
| Mining and Quarrying | 61,961 |
| Whole sale and retail | 130,644 |
| Agriculture, animal husbandry and forestry | 106,720 |
| Construction | 75,738 |
| Electricity, gas and water | 22,658 |

Economic growth reached about 1.2 % in 2015 and 2016, owing to sizeable foreign investment in mining and oil. According to preliminary figures from the General Bureau of Statistics (ABS), consumer prices on a monthly basis (basis: April 2016- June 2016) increased by 0.5 % in January 2018 compared to December 2017. Comparing January 2018 with January 2017, consumer prices have risen by an average of 8.9 %.

[26] ABS 2010

[27] ABS 2017 The currency exchange for 1 USD is 7.415.

### 2.1.4. *Environmental overview and concerns*

#### 2.1.4.1. Environmental background

Suriname, with a landmass of 163,820 km$^2$, accounts for 0.11 % of the Earth's total land mass. 93 % of the country is covered by pristine tropical rainforest. Its rich biodiversity includes rare, endemic plant species and several endangered species of wildlife. Compared with globally known species, Suriname has:

- 2.0 % of the world's higher plant species;
- 3.1 % of the world's fish species;
- 1.5 % of the world's amphibian species;
- 1.7 % of the world's reptile species;
- 7.6 % of the world's bird species; and
- 4.8 % of the world's mammal species[28]

Apart from its biodiversity, Suriname is particularly rich in subsoil resources: minerals, such as bauxite, and gold, where gold is one of the country's main sources of income next to oil and timber. Agriculture is primarily practiced in the coastal plain areas and river valleys. The main cash crop is paddy (rice). Other commercial crops include bananas, coconuts, plantains, peanuts, and citrus fruits. In addition, small-scale farm holdings produce a variety of vegetables and fruits. Shrimp and fish farming are expanding along the coast. Recently, LVV has started drafting the concept for establishing a research and innovation centre in collaboration with ADEKUS to support this sector.

Moreover, other business activities relating to nature tourism are increasingly seen in a lucrative light. In addition, Suriname can benefit from the compensation of carbon credits. However, these activities are dependent on the preservation of the nation's natural wealth, its forest, water, and soil. Nevertheless, several threats face this natural wealth.

#### 2.1.4.2. Main environmental concerns

The main environmental threats, risks, and issues derived from economic exploitation of the natural resources, the industrial activities, and households are:

- Seawater intrusion due to man-made water reserves that prevent water flowing to the sea;
- Air pollution from vehicles and industry;
- Depletion of fish and shrimp resources due to over-fishing[29];
- Increasing oil exploration with risks for environmental damage;
- Groundwater pollution due to the lack of proper storm water and household water drainage;
- Soil and water pollution due to poor waste management. With virtually limited waste separation or re-use of waste, both the collection and disposal of waste are of concern. Except for the car wreckages that are being collected and exported and plastic bottles that are being recycled, the collected waste is mainly disposed of at open landfills. There is also pollution of surface water due to extensive use of fertilisers;
- Mercury pollution of fertile soil and downstream waters due to small scale gold mining activities;
- Drainage of polluted industrial waste water;

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[28] Suriname 3rd National Report to the Convention on Biological Diversity; September 2009

[29] Suriname control their fishing but there is a global overfishing (FAO 2016 www.fao.org/3/a-i5555e.pdf)

- Indiscriminate issuance of lumber and mining concessions in the interior are examples of the comprehensive national environmental and social problems; and
- Wastewater treatment is restricted at best to treatment by septic tanks (stabilising sewage), followed by discharge into the surface water, which ultimately makes its way to the sea.

From the above-mentioned main threats, the following three issues (waste management, industrial emissions, and contaminated sites) are closely linked with the POPs topics and potential NIP activities. A more detailed description follows:

**a) Waste management**

Suriname possess no specific policy or laws regarding waste collection, treatment and management in general. Only certain rules and regulations have been put in place by the former Ministry of Labour, Technological Development and Environment (ATM), more specifically the Directorate Environment, which is now CM. Waste separation or recycling are almost non-existent. The Waste Management of Suriname is in a developmental stage, and currently, existing systems are being evaluated and new systems are being designed to cope with the waste generated.

Momentarily the waste generated from the District of Paramaribo, Wanica, Commewijne, Para and Saramacca is disposed on the Ornamibo open dump in the District of Wanica, south of Paramaribo. The management of this site is done by OWTC. Other open dumpsites are assigned by the respective District Commissioners (DCs). The Ornamibo dump was opened in 1999 as a temporary solution for waste disposal but has since become the permanent dumpsite of Greater Paramaribo. Because of the increasing urbanisation in and around Paramaribo, more and more houses have been built in the vicinity of the dumpsite. A thorough assessment has recently been made regarding the Ornamibo open dumpsite in the development of the landfill demonstration project within the regional POPs project. Improvement of waste management and education to prevent long-term contamination is urgently needed and is currently developed.

Private households do not pay for collection or treatment of waste (which is paid by the Government). Households or industries thus have no incentives to reduce the amount of waste they produce. Unlike other South American countries (e.g. Brazil), the private sector is only modestly involved in the recycling activities in Suriname.[30]

The National Chemical Profile Suriname (NCPS) details the situation for chemical waste*:" Generally, multinational and large-scale companies as well as some medium scale companies do have data on chemical solid waste including the type and quantity of waste. However, there is no information on the composition of this waste. In many cases when chemical waste cannot be destroyed, companies collect and store their chemical waste. It is unknown which stage these chemicals are in, and if their storage complies with proper storage guidelines. Most companies hire a waste disposal service company to collect and destroy or dump (chemical) waste. These waste-collecting/destruction companies usually receive a permit from OWTC to collect and dump (chemical) waste at the public dumpsite which is owned and managed by the Government." For the transport of waste, no permit is needed. The current cost for dumping is SRD 10/tonne (US$ 1.3).*

The NCPS further highlights that *"Until now, there is no national chemical waste management plan. There is only one private company specialised in chemical waste collection and destruction. With respect to the waste landfill, there is one public landfill which is a Government entity. The public landfill, Ornamibo, located in district Wanica, is circa 20 hectares with a lifetime of 20 – 25 years. Since 2002, the public dumpsite has been in the state of rehabilitation, to be transformed into a controlled landfill, to include the collection and disposal of chemical waste. However, the process was slow and only recently within the regional POPs project a demonstration project is under development to significantly improve the situation and to develop a sanitary landfill. With respect to the other districts, the DCs assign a public landfill for their respective district; in reality, it is not regularly supervised. The figures of the amounts of waste show that, in general,*

[30] https://ecotravelrally.wordpress.com/2014/08/06/surinames-waste-management-is-landfilling-all-suriname-can-do-about-waste/

*the amount of disposed waste has decreased. However, the amounts of hazardous waste materials have increased".* The NCPS conclude, *"Since the municipal garbage open dump, it creates great risks for the soil, groundwater and neighbouring surface water contamination, as well as air pollution (methane emissions and odour), all leading to serious health risks for the local people."*

In this respect, it needs to be highlighted that the new listed industrial POPs like some brominated flame retardants (PBDEs and HBCD) and fluorinated alkylated substances (PFOS and related substances; PFOA and related substances) are present in everyday goods (electronics, car shredder residues, synthetic carpets, flame retarded or surface treated textiles, furniture, mattresses etc.) (See inventories in Section 2.3) and therefore in household waste that finally ends up in landfills and open dumps. In this way, persistent and semi volatile POPs can migrate and leach out of dumpsites/landfills[31,32] into the wider environment with the potential to contaminate soil and groundwater, and ultimately, be a threat to human health.

*Table 4. Amount of waste disposed of in tonnes, 2017 at Ornamibo*

| **Waste type** | **2017 (in tonnes)** |
|---|---|
| Household waste | 112,541 |
| Agricultural waste | 12,610 |
| Industrial waste | 22,082 |
| Large / demolition waste | 9,717 |
| Other waste types | 9,745 |
| **Total** | **166,694** |

*Source: baseline study Demonstration Project; OWTC*

The various hospitals in Paramaribo generate a combination of infectious waste including needles and small pathological waste. For instance, 's Lands Hospital generates about 600 – 800 kg / week of this type of waste. Large pathological waste is buried by a funeral organisation. In addition, it generates non-infectious kitchen and household waste. Currently, different waste streams are labelled and separated in different plastic bags. Infectious waste is collected by the Recycling Company Suriname (ReComSur), who currently transports the waste to the incinerator of the Dr. L. Mungra Streekziekenhuis Nickerie. Previously, the Laundry Service Private Hospitals (WASPAR) did this. ReComSur also collects hospital waste from other hospitals, general practitioners, dentists, etc. Totally about 1000 – 1500 kg / week of hospital waste is collected against a fee of 10 – 20 SRD / kg. Existing hospital waste incineration facilities are located at: Dr. L. Mungra Streekziekenhuis Nickerie; WASPAR and the Academic Hospital of Paramaribo (AZP)[33]. Recently, VG signed a Public Private Partnership contract with a waste management company. This partnership is part of the Government's policy to outsource some of its activities regarding waste collection and disposal, which still need to show appropriate effectiveness, and needs further evaluation. In this respect education towards maintenance on a regular basis of equipment is urgently needed along with the appropriate mind shift.

Moreover, the education specifically in chemistry, chemical storage and chemical waste management is needed. Training for the storage of chemical waste has been given to laboratory personnel of the ADEKUS two times. But lack of adequate storage places is still a big problem. Experiences in industrial countries

[31] Hamid H, Li LY, Grace JR (2018) Review of the fate and transformation of per- and polyfluoroalkyl substances (PFASs) in landfills Environmental Pollution 235, 74-84.

[32] Lang JR et al. (2017) National Estimate of Per- and Polyfluoroalkyl Substance (PFAS) Release to U.S. Municipal Landfill Leachate. Environ Sci Technol. 51(4), 2197-2205.

[33] Provision of Consultancy Services for the Design and Assessment of the BAT-BEP Solid Waste Demonstration Project in Paramaribo, Suriname (Baseline Report,2017), 33-75.

have revealed the high cost of securing and remediating landfills containing hazardous chemicals and wastes. According to the ‘polluter pays principle’ companies who have deposited their wastes on such landfills have to bear (part of) the high securing and remediation costs. Considering these findings from the NCPS and the UPOPs inventory, the improvement of waste management is of urgency from several perspectives, and it should have a high priority in the overall action plan of the NIP.

The intensive scale of small-scale gold mining, along with the significant misuse of unrecovered mercury, has led to the salinisation of rivers and creeks in the mining areas. Also, formation and subsequent bioaccumulation of methylmercury is one of the greatest risks for human exposure to mercury, besides occupational exposure to elemental mercury. Other consequences of the gold industry include the serious disruption of the physical landscape, social conflicts and crime. The economic benefits of small-scale gold mining remain significant, but so does the seriousness of the social and environmental consequences and therefore there is a need for clear and unambiguous deterrents to the negative consequences. The environmental impacts of the mining sector must be considered because of the resulting destruction of the physical, social and cultural environment. In addition to short-term damage, the long-term feasibility of the mining sector becomes questionable if impacts are not managed. Furthermore, the effect of large-scale projects on the social environment must not be neglected. Most of the mining activities in Suriname are within the Greenstone Belt, where maroon and indigenous people are residing. Mechanisms need to be developed and ways must be found to better understand the impacts and implications and improve overall sustainability in the mining sector.[34] Fortunately, the Ministry of Natural Resources (NH) will start implementing the GEF funded project ‘Improving Environmental Management in the Mining Sector of Suriname, with emphasis on Gold Mining” soon to start addressing these issues.

### b) Industrial emissions

Another threat to environmental integrity is industrial emissions. The emission from industrial facilities depends on the type of facility and the technologies installed for emission control. Emission standards are currently not yet implemented and currently, no air emission standards are set. Standards of the Environment Protection Agency of the United States of America are often used. With respect to water emissions, the NCPS notes, *“It must also be noted that some companies adjacent to a river or channel are accustomed to discharge (chemical) waste into the latter. Multinational companies consider international water quality standards for discharging waste water into water streams.”* Furthermore, it has been discovered during the UPOPs inventory for the NIP that for the Environmental Impact Assessment (EIA) the technologies used for large-scale facilities are not sufficiently described (e.g. there is no prescribed guidance on water or off-gas cleaning technologies) and assessed. But firstly, the monitoring and policy should be in place. Fortunately, work is in progress in this regard.

It can be concluded that poor construction, uncontrolled emissions from industries and other facilities lead to environmental contamination of water, air, and soil with the risk of generating contaminated sites over time.

### c) Contaminated sites

Contaminated sites are a result of inadequate waste management, mismanagement or of the deposition of hazardous chemicals to soil (e.g. use of persistent pesticides or POPs in other material released to the environment like PFOS use in specific fire-fighting foams). Furthermore, the uncontrolled releases of persistent and toxic substances from industries and other facilities to air, water, and soil can lead to contaminated sites over time. Above all, there is a tremendous lack of education of proper handling of chemicals to prevent contamination via chemical waste and handling of pollution.

[34] International Institute for Sustainable Development (2015). Water-Energy-Food Security and Mining in Suriname - A project overview. https://www.iisd.org/sites/default/files/publications/water-energy-food-security-mining-suriname-project-overview.pdf

Industrial development and associated releases may lead to contaminated sites, which are a large burden to industrialised economies.[35] Industrial and commercial activities, as well as the treatment and disposal of waste, are reported to be the most important sources. Although considerable efforts have been made already, it will take decades to clean up the legacy of contamination. The costs for these activities are likely to be enormous and include remediation of not only soil, but also groundwater and sediments. These enormous costs and associated assessments[36] demonstrate that only prevention of contaminated sites in the first place represents a sustainable solution and a means to arrest the continued development of contaminated site challenge. It has been highlighted that with the continuing shift of industrial activities to developing countries and countries in transition with a lack of regulation, additional challenges in relation to contaminated sites are expected to emerge globally.[37][38].

For Suriname, within the SC inventory process of POPs, it has been discovered that for all POPs groups (pesticides, PCB, UPOPs and newly listed POPs) a range of contaminated and possibly contaminated sites are present.

A pesticide stockpile of 96.4 tonnes has been removed in August 2016 from Suriname and incinerated in the United Kingdom. This was part of the 314 tonnes of obsolete pesticides (OBs) that were removed from the Caribbean under the FAO/GEF project.

More illegal dumps and landfills are emerging with the increased imports and consumption of goods. Considering POPs chemicals, such deposits have the potential to become contaminated sites in the future.

## 2.2. Institutional, policy and regulatory framework

This section describes the present overall institutional, policy, and regulatory framework within which the NIP will be implemented. It also covers more detailed baseline information about the POPs issue such as the status of action and implementation activities under related Conventions or regional and sub-regional agreements.

### *2.2.1. Introduction*

Several ministries and institutes within the Government have tasks and responsibilities related to environmental management. According to the State Order “Taakomschrijving Departementen 1991” (S.B. 1991 no. 58) zoals laatstelijk gewijzigd bij S.B. 2017 no.22”, CM is assigned the task to develop, coordinate and monitor environmental policy for the country. As the FP for Suriname of most environmental agreements, this Entity is responsible for implementing the country’s obligations under these agreements. Most recently, on March 8, 2018, the DNA approved the Minamata Convention on Mercury for ratification and the Paris Agreement was approved on the 26th of June 2018.

One of the main priorities of the Government is the establishment of an adequate legal framework for environmental management, the Environmental Framework Law. The Pesticide Act and the Negative Lists are currently the main legislative instruments to regulate POPs.

[35] E.g. https://www.eea.europa.eu/data-and-maps/indicators/progress-in-management-of-contaminated-sites-3/assessment

[36] see e.g. Montague P (2006): The modern approach to problems: Prevention. Rachel's Democracy & Health News #845, http://rachel.org/?q=en/node/6408

[37] Weber R, Gaus C, Tysklind M, Johnston P, Forter M, et al. Dioxin- and POP-contaminated sites – contemporary and future relevance and challenges. Env Sci Pollut Res 15, 363-393 (2008).

[38] Weber R, Aliyeva G, Vijgen J. (2013) The need for an integrated approach to the global challenge of POPs management. Environ Sci Pollut Res Int. 20, 1901-1906. http://link.springer.com/content/pdf/10.1007%2Fs11356-012-1247-8.pdf

### 2.2.2. Institutional framework

Several governmental bodies form the National Institutional Framework for environmental management in Suriname, namely:

- CM, which was established at the Cabinet of the President since November 2015, is responsible for coordinating the implementation of the national environmental policy. This office holds the FP for the SC and all other major environment-related Conventions.
- Sectorial ministries with environment-related tasks such as LVV, OWTC, VG, HI&T, NH, Ministry of Regional Development (RO), the Ministry of Defence (DEF), Ministry of Justice and Police (JP) and the Ministry of Labour (LB).
- Other governmental agencies such as the National Institute for Environment and Development in Suriname (NIMOS) as technical execution agency to CM, the National Coordination Commission for Disaster Management (NCCR) and the Bureau for Public Health (BOG).

### 2.2.3. Legal framework, roles and responsibilities

At present Suriname has no legislation that is specifically aimed at addressing POPs, except for the Pesticides Act. However, there are several laws and regulations that can be applied in the absence of specific POPs legislation. The legislative framework for environmental management is based on the Constitution of the Republic of Suriname, which entrusts the State with the responsibility to create and promote conditions, necessary to protect nature and preserve ecological balance.

In addition, the State must supervise the production, availability, and trade in chemical, biological, medical (pharmaceutics) and other products, intended for consumption, medical use, and diagnoses. The State also supervises all medical professions, pharmacists and other medical practices. The monitoring of above-mentioned products and professions is subject to enforcement by law.

The import and export of chemicals, including certain POPs are regulated through the State Order Negative List, which regulates the import and export of goods. This list is being amended regularly to comply with international conventions ratified by Suriname. Amendments to this State Order have been made based on the Montreal Protocol for Ozone Depleting Substances (ODS)[39], FAO Negative List, and the Convention on Chemical Weapons. Currently, PCB-containing materials are on this list as being goods for which a license is required. This regulatory instrument is flexible in comparison with Acts approved by the DNA. However, Government approval is required to make any adjustments to the aforementioned list. With the ratification of SC and BC, it is foreseeable that the import and export of POPs and hazardous waste will also be regulated through the aforementioned State Order Negative List.

The responsibilities for the ministries include:

1. LVV, responsible for pesticides control;
2. OWTC, responsible for waste collection and processing in Paramaribo and responsible for the ports in Suriname;
3. VG, responsible for public health;
4. HI&T, responsible for issuance of permits for the industries in both the import as well as export sectors;
5. NH, responsible for regulating the mining industries;
6. RO, responsible for waste collection in the districts outside Paramaribo;
7. DEF, responsible for disaster management;
8. JP, responsible for enforcement in general; and
9. LB, responsible for monitoring compliance with labour laws

[39] Exception has been asked in 2017 for methyl bromide for the import of 1000 kg, for the use in wood log in the export to India

The management of POPs, through the stages of their lifecycles is also a shared responsibility of several ministries. A general overview of the responsibilities of the different ministries, agencies and other institutions for the different stages of the chemical life cycle is presented in Table 5. Under the terms of the SC, legislation will be enacted, and institutions will be entrusted with certain tasks related to POPs management. Table 5 presents an overview of ministries and agencies with their proposed and foreseen contributions to POPs management.

*Table 5. Stages of the chemical life-cycle and responsible institutions*

| **Concerned Ministry / Agency** | **Import** | **Production** | **Storage** | **Transport** | **Distribution/ Marketing** | **Use/handling** | **Disposal** |
|---|---|---|---|---|---|---|---|
| VG[40] | X | X | X | | X | X | X |
| LVV | X | | X | | X | X | X |
| NH[41] | | X | X | X | | | X |
| CM[42] | X | X | X | X | | X | X |
| HI&T[43] | X[44] | X[45] | X | X | X**Error! Bookmark not defined.** | | |
| FIN [46] | X | | | | | | |
| OWTC | | | X | | | | X |
| RO [47] | | X | X | X | X | X | X |
| JP [48] | X | X | X | X | X | X | X[49] |
| DEF[50] | X | | X | X | | X | X |
| LB | | | | | | X | |
| BUZA[51] | | | | | | | |
| Others | X[52] | X | X | X | X | X | X |

[40] Department Bureau of Public Health: Department of Environmental Inspection (storage, production, use/handling and disposal) and Sanitation (importation, production, storage distribution/marketing, waste disposal) 16. Pesticide Department Subdivision of Agricultural Research, Marketing and Processing.

[41] Mining of minerals.

[42] Includes the Labour Inspection and NIMOS (since NIMOS lacks a legal basis, its plays an advisory role instead of enforcement).

[43] Transportation by water, air and road and facilities for water and air transportation 29.
Port Authority.

[44] Department Import, Export and Foreign Exchange Control, 'Dienst IUD'.

[45] Department for Operating Licenses (Afdelingbedrijfsvergunning).

[46] Customs Department.

[47] District Commissioners.

[48] Narcotics: Police (import, disposal); Fire Department, Law Enforcement (Police).

[49] Procurator-general formally approves destruction or it is delegated to relevant departments.

[50] Explosives (import, storage, transport, use/handling, disposal); National Coordination Commission for Disaster Management (NCCR).

[51] International agreements (Basel Convention, Rotterdam Convention, SC etc.).

[52] By Presidential Order, stipulators regarding transport, import, export, transit, production and sale of gunpowder, and other highly flammable explosives

*Table 6. Overview of ministries and agencies with their proposed/foreseen contribution to POPs management*

| **Proposed/Foreseen Contribution** | **Functions-Primary Responsibilities** | **Ministries/Agencies** |
|---|---|---|
| Promulgation of legislation<br>(including bans/restriction of the production and use of POPs, as well as emissions limit from unintentional sources)<br>Permitting | Coordination<br>Permitting<br>Enforcement<br>Standards<br>Awareness | CM<br>LVV<br>VG<br>HI&T<br>Suriname Bureau of Standards (SSB) |
| Focal point<br>Coordination of all POPs activities of all the ministries and departments<br>Implementation of NIP | Policy and Coordination | CM |
| Statistical data on POPs | Monitoring, data management, publication of Data collection | ABS, LVV<br>FIN, HI&T, VG |
| Contribution in providing funds to implement SC | Financing<br>Networking and lobby | FIN<br>CM |
| Certified lab testing | Standards for Laboratories<br>Identifications of laboratories | VG<br>Assigned Laboratories<br>HI&T/SSB |

LVV has prepared comprehensive legislation covering the management of pesticides. The Pesticides Act, which was last amended in 2005, incorporates the international techniques for the management of pesticides. The FAO Code of Conduct on the Distribution and Use of Pesticides provides the inspiration and guidance for the Pesticides Act and Pesticides State Order. The Pesticides Act also incorporates the Prior Informed Consent (PIC) procedure.

The Pesticides Act further gives authority to LVV and VG to regulate the ban of certain pesticides. In accordance with the Pesticides Act, it is prohibited to transport, import, store, sell or use that are listed on the FAO Negative List for agricultural purposes pesticides. This list is automatically adjusted whenever the RC prohibits a pesticide. LVV has published a list of pesticides that are prohibited in Suriname. Appendix 1 provides a copy of the aforementioned published list. This list also includes the following POPs: Aldrin, chlorodane, DDT, dieldrin, heptachlor, HCB, and toxaphene, including a newly listed POP, namely lindane.

In January 2018 a new State Order was signed to extend the list of banned pesticides to include endrin, impregnate salts (known as Wolman salts), methamidophos, carbofuran, dimethoate, and endosulfan. With the ratification of the SC, the list of banned pesticides will be extended to include the rest of POPs.

Ministerial Order regulates labelling of pesticides.

CM is in the process of finalising the draft Environmental Framework Law. Currently, this draft is under review to streamline it with the policy and new structures of the newly established Government. When DNA passes it, general aspects of environmental management will have a sound legal basis. This draft Act specifically deals with pollution control. It is advisable to review the prepared draft laws (draft environmental law and draft waste management act) to see to what extent they could contribute to the implementation of the SC and BC.

It is noteworthy to mention that while awaiting the enactment of the Environmental Framework Act, NIMOS uses a system to handle environmental complaints and keeps a database of all complaints and their responses. In addition, NIMOS provides environmental advice on environmental matters to permitting agencies such as HI&T and the DCs. NIMOS has even developed guidelines for storage of chemicals and petroleum products, but currently these can only be enforced if incorporated in the permits of the aforementioned permitting agencies. It is noteworthy to mention that since these advices currently lack the support of the law, the permitting agencies are not obliged to act on the advice.

### *2.2.4. Relevant international commitments & obligations*

Environmental degradation has always been a concern of the Government of Suriname. To improve efforts to protect nature and human health, the Government of Suriname has ratified several international environmental agreements. However, efforts to bring social and economic development for the country, and environmental management at the same time, have been very challenging. Noteworthy is Suriname's commitment to cap its forest cover at 93%. The following list of international agreements (Table 7) establishes the positive efforts that have been made over the last several decades.

*Table 7.International agreements signed by Suriname*

| No | Title | Year of ratification / signing |
|---|---|---|
| 1 | International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 | 1976 |
| 2 | Treaty on the Non-Proliferation of Nuclear Weapons, The Non-Proliferation Treaty; NPT | 1976 |
| 3 | International Plant Protection Convention, IPPC | 1977 |
| 4 | Treaty of Tlatelolco for the Prohibition of Nuclear Weapons in Latin America and the Caribbean | 1977 |
| 5 | London Convention on Prevention of Pollution by Dumping of Wastes and Other Matter 1972 | 1980 |
| 6 | Convention on International Trade in Endangered Species of Wild Fauna and Flora | 1981 |
| 7 | Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat | 1985 |
| 8 | International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto | 1989 |
| 9 | Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water, Partial Test-Ban Treaty | 1993 |
| 10 | Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction; Biological and Toxic Weapons Convention | 1993 |
| 11 | United Nations (UN) Convention on Biological Diversity | 1996 |
| 12 | Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Chemical Weapons Convention | 1997 |

| No | Title | Year of ratifica-tion / signing |
|---|---|---|
| 13 | Vienna Convention for the Protection of the Ozone Layer | 1997 |
| 14 | Montreal Protocol on Substances that Deplete the Ozone Layer | 1997 |
| 15 | UN Framework Convention on Climate Change | 1997 |
| 16 | UN Convention on the Law of the Sea | 1998 |
| 17 | UN Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa | 2000 |
| 18 | Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade | 2000 |
| 19 | Comprehensive Test-Ban Treaty | Signed 2006. Convention will come into effect when the required 44 countries mentioned in the annex ratified |
| 20 | Kyoto Protocol | 2006 |
| 21 | 1996 Protocol to the London Convention on Prevention of Pollution by Dumping of Wastes and Other Matter 1972 | 2006 |
| 22 | Stockholm Convention on Persistent Organic Pollutants | 20 September 2011 |
| 23 | Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal | 20 September 2011 |
| 24 | Minamata Convention on Mercury | Approved by the DNA on March 8, 2018 |

### *2.2.5. POPs-management and monitoring requirements*

As mentioned earlier, apart from the Pesticides Act, Suriname has no legislation that is specifically aimed at addressing POPs. However, there are several laws and regulations that can be applied in the absence of specific POPs legislation. The current legislation is fragmented over several ministries and agencies, and part of it is out-dated. In addition, different ministries have responsibilities with regards to POPs management. Their mandates are based on the State Order "Taakomschrijving Departementen".

- The first Government entity that directly encounters POPs when they are imported is the Customs Department of the Ministry of Finance (FIN). This Ministry is responsible for levy and indirect tax collection. The Customs Department is responsible for checking whether goods are imported legally (with the required permit). Customs also collect the related taxes and is physically present at the port when the goods are cleared. Currently, the Customs and the workers at the different ports lack the capacity to detect and handle chemicals in general. A group of 15 customs officers has already been trained in identifying pesticides, how to handle when importing pesticides and also in the existence and the work of the BC, RC and SC.[53] The Custom Department has also been trained by NIMOS through the Project "*Monitoring the Activities in the Refrigerant Management Plan (RMP)*", to identify equipment containing Ozone Depleting Substances (ODS) when they enter the country.

- HI&T is responsible for the issuance of licences for the import and export of goods. Based on the State Order Negative List, certain chemicals (all types of waste, pesticides and chemicals on the FAO Negative List, chemicals and radioactive waste and chemical weapons) are banned, while a license is required for others. For example, licenses are required for pesticides that are not included on the FAO Negative List and PCB-containing materials. In practice, when a license is being requested to import these pesticides, HI&T requests advice of LVV. With the ratification of the SC, it is expected that POP chemicals will be included in the State Order Negative List.
- With regards to POP-pesticides, LVV is responsible for the enforcement of Pesticides legislation. LVV is authorised, in consultation with VG, to prescribe by regulation which pesticides are banned. LVV decides whether a pesticide can be imported. The Pesticide Department of LVV is involved in the enforcement of the rules and regulations for pesticides, regulating imports, correct labelling, distribution and disposal. The Extension Officers of LVV are responsible for training in the safe handling and use of pesticides. Furthermore, LVV is currently awaiting the enforcement of the State Decision on storage and sales.
- VG is responsible for public healthcare. It is responsible for food safety and sanitation, and guidance in the destruction of pharmaceuticals, clinical and industrial waste. The Environmental Inspection of BOG is responsible for inspection of water, soil, and air pollution. They are involved in different stages of the chemical cycle: import, production, storage, use/handling, and disposal. Pharmaceutical Inspection operates on behalf of the Permanent Secretary of VG. The Pharmaceutical Inspection is responsible for the supervision of the import, production, sale, and destruction of pharmaceuticals in Suriname. The new building of Central Laboratory of VG was opened in September 2010. This laboratory is used as a reference laboratory for the different ministries like JP, HI&T, LVV, and VG. Monitoring of the presence of toxic substances in food (toxic metals, mycotoxins, POPs and pesticides) are carried out. Also, Human Biomonitoring for toxic metals (mercury and lead) and organic contaminants are planned in the future. Patients suspected to have mercury intoxication are referred to the Central laboratory for mercury analysis in blood, urine or hair. Also, Human Biomonitoring for exposure to toxic metals such as mercury and lead is carried out. To expand the ISO 15189 accreditation scope of the Central Laboratory, it is expected that the mercury analysis in human matrices will be audited in October 2018. Work is in progress to also include POPs in human milk, blood etc. at a later stage.
- The upgrading of other laboratories also took place. These include the chemical laboratory of the ADEKUS, the Fish Inspection Institute (VKI), and the Agricultural Health and Food Safety Institute (AGVIS) at LVV. AGVIS is responsible for the coordination, monitoring, administration and reporting of agriculture health activities at LVV. VKI is established to execute the Fish Inspection Act of 2000, and thereby conducts activities such as determining of quality standards for all fisheries products and executes all necessary inspections and control for quality assurance of fisheries products. One of the achievements of VKI is the establishment and implementation of an annual Residue Monitoring Plan for aquaculture products in compliance with European Union (EU) regulations. The program monitors the following possible residues in aquaculture products at farm level: Chloramphenicol, Nitrofurans, Tetracyclines, Oxolinic acid, Enrofloxacin, Emamectine, sum of DDTs, Malachite green, Leuco-malachite green, and Crystal violet). As mentioned in the NCPS, an update of the survey of laboratories needs to be done because the last survey was executed in 2001.
- The DCs under RO are responsible for granting permits based on the Hindrance Act. These permits are required for setting up establishments, which may cause hindrance to others: e.g. set up of shops, service stations, or paint spraying boots for cars. Since the DC is not obliged to ask advice from LVV

[53] LVV is pushing forward in repeating the trainings/workshop toward other ministries e.g. JP, Fire Brigade, DEF,HI&T, because these are the ministries that are the second in line to get exposed to pesticides in their line of duty

or any other relevant governmental institutions, instances can be found where often these “Hindrance Act” permits are issued without environmental, health or safety requirements. For example, it often occurs that permits are granted to retail shops where also pesticides are in their possession without consulting LVV. Due to this shortcoming in the Law, LVV does not have adequate data on the pesticides that are for sale and no adequate provisions are put into the permit. However, it must be noted that LVV is collaborating with HI&T - which is responsible for issuance of operating licenses for enterprises - to monitor these retail shops.

- DEF is amongst others responsible for providing assistance in case of disasters. NCCR under DEF is responsible for monitoring and assessing social development to identify potential disasters and crises. NCCR has a coordination structure in place in collaboration with several Ministries and organisations in case of a disaster with chemicals.
- LB is pre-eminently responsible for monitoring compliance with labour laws. The Labour Inspection Department is responsible for the enforcement of the regulations on safety and occupational health in Suriname. They also provide advice and guidance to employers as well as employees.
- CM is, as mentioned before, responsible for the development of an overall environmental policy and the coordination and monitoring of all activities regarding environmental policy. Special attention is given to the issue of chemicals.
- NIMOS, the technical executing agency to CM provides amongst others, environmental technical advice on the storage and handling of chemicals to: DC (Hindrance Act permit), HI&T (permit for establishment of enterprises) and Customs (import of chemicals). On an ad hoc basis, NIMOS has guided transportation for chemicals of private companies from the port to the company’s facility. The draft Environmental Framework Law does consider measures and has provisions to handle adequately the issues of pollution and pollution management. This draft contains a specific chapter on pollution-control regulating aspects like environmental norms and standards, notification of spills or releases of contaminants, national register for sources of pollution, environmental permits, and historical pollution. In anticipation of the Environmental Framework Law, NIMOS has also prepared several guidelines which are relevant for chemicals management in general. These are:
  - Guidelines for conducting Environmental and Social Impact Assessments;
  - Guidelines for setting up depots for chemicals;
  - Guidelines for setting up and use of incinerators for medical waste;
  - Guidelines for petroleum products; and
  - Guidelines for Spraying Boots.

## 2.3. Assessment of POPs issues in the country

Assessment of current POPs management in the Suriname is based on inventories of pesticides, polychlorinated biphenyls (PCBs), Polybrominated diphenyl ether (PBDE), Hexabromocyclododecane (HBCD), DDT, Perfluorooctane sulfonic acid (PFOS) and related substances, and unintentional production of POPs (UPOPs: polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), HCB and PCB) are described in this section.

It also presents information on current POPs stockpiles, contaminated areas and waste, remediation of contaminated areas, POPs levels in different environmental media, prediction of future POPs production, use and release. Furthermore, it presents POPs monitoring in Suriname, as well as current information level, knowledge and education levels of each target group, and the mechanism for information exchange with other parties of the SC.

### 2.3.1. Assessment of POPs Pesticides (Annex A, Part I)

#### 2.3.1.1. General

In many parts of the world, poorly stored obsolete POPs-pesticides stocks and other hazardous pesticides in dumpsites, landfills, and warehouses await clean-up and final disposal. According to a 2002 report, there are approximately 50,000 tonnes of POPs pesticides in Africa with an estimated cost for management and destruction of US$ 250 to 300 million. At the present rate of disposal, it would take more than 100 years to destroy all these stocks (World Bank, 2002)[54].

A comprehensive overview on pesticide stockpiles of South American countries is not yet available. The chemicals in this category of POPs include: aldrin, chlordane, dieldrin, endrin, heptachlor, HCB, mirex, and toxaphene. They are listed in Annex A of the SC along with the other POPs which are chemicals to be eliminated. However, the Convention has noted special exemptions, such as: (i) the use of Aldrin as ectoparasiticides and insecticides; (ii) chlordane for registered parties production and use as local ectoparasiticide, insecticide, termiticide and additive in plywood adhesives, dieldrin in agriculture; (iii) heptachlor a termiticide, wood treatment, and protection of underground cable boxes; and (iv) HCB production for registered parties as allowed and for use as an intermediate solvent for pesticide and closed-system site-intermediate, mirex for use as a termiticide, and production for registered parties.

The main characteristics of the chemicals in this category of POPs are:

- **Aldrin** is an organochlorine insecticide that was widely used until the 1970s when it was banned in most countries. It is a colourless solid. Before the ban, it was heavily used as a pesticide to treat seed and soil. Aldrin and related "cyclodiene" pesticides became notorious as POPs. Aldrin is highly lipophilic.
- **Chlordane**, or chlordan, is an organochlorine pesticide. Chlordane was a manufactured chemical, commonly used between 1948 and 1988. This white solid was sold in the U.S. until 1983 as an insecticide for crops like corn and citrus and on lawns and domestic gardens as well as a method of termite control. Pathways of exposure to chlordane include ingestion of crops grown in chlordane-contaminated soil, ingestion of high fat foods such as meat, fish, and dairy — as chlordane builds up in fatty tissue – as well as through inhalation of air near chlordane treated homes and landfills. Chlordane is excreted slowly through faeces and urine elimination, as well as through breast milk in nursing mothers, and it can cross the placenta and become absorbed by developing foeti in pregnant women.
- **Chlordecone** is an organochlorine pesticide chemically related to mirex. It was used in agriculture mainly in banana plantations and has been phased out more than 25 years ago. Chlordecone is highly persistent in the environment, has a high potential for bioaccumulation and biomagnification. Locations

[54] World Bank (2002) AFRICA: Africa Stockpiles Program (ASP): Funding the prevention and disposal of obsolete pesticides from African countries Work Program Inclusion – Resubmission – (FAO – World Bank Co-Submission) Project Brief 11th September 2002.

where chlordecone has been used in the past are still contaminated. It is classified as a possible human carcinogen and is very toxic to aquatic organisms.

- **Dieldrin** is a chlorinated hydrocarbon originally produced as an insecticide. Dieldrin is closely related to Aldrin, which reacts further to form dieldrin. Aldrin is not toxic to insects; it is oxidised in the insect to form dieldrin which is the active compound. Originally developed in the 1940s as an alternative to DDT, dieldrin proved to be a highly effective insecticide and was very widely used during the 1950s to early 1970s. However, it is extremely persistent; it does not break down easily. Furthermore, it tends to biomagnify as it is passed along the food chain. Long-term exposure has proven toxic to a very wide range of animals including humans - far greater than to the original insect targets. It has been linked to health problems such as Parkinson's disease, breast cancer, and immune, reproductive, and nervous system damage. It can also adversely affect testicular descent in the foetus if a pregnant woman is exposed to it.
- **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. 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. Endosulfan has been listed with exemptions for crop-pest complexes as a broad-spectrum insecticide and is still used to control a range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy. Endosulfan is acutely neurotoxic to both insects and mammals, including humans. The Environmental protection Agency of the USA classifies it as Category I: "Highly Acutely Toxic".
- **Endrin** is an organochloride that was primarily used as an insecticide. It is a colourless, odourless solid, although commercial samples are often off-white. It is also a rodenticide. This compound became infamous as a POP. Like related organochlorine pesticides, it is lipophilic. Thus, it tends to accumulate in fatty tissues of organisms living in water. Some estimates indicate its half-life in soil is over 10 years. In comparison with dieldrin, endrin is less persistent in the environment.
- **Heptachlor** is an organochlorine compound that was used as an insecticide. Usually sold as a white or tan powder, Heptachlor is one of the cyclodiene insecticides. In 1962, Rachel Carson's *Silent Spring* questioned the safety of Heptachlor and other chlorinated insecticides. Due to its highly stable structure, Heptachlor can persist in the environment for decades. One study described its half-life to be 2 years and claimed that its residues could be found in soil 14 years after its initial application. Like other POPs, Heptachlor is lipophilic and poorly soluble in water; thus, it tends to accumulate in the body fat of humans and animals. Heptachlor epoxide is more likely to be found in the environment than its parent compound. The epoxide also dissolves more easily in water than its parent compound and is more persistent. Heptachlor and its epoxide absorb soil particles and evaporate.
- **Hexachlorobenzene (HCB),** is a fungicide formerly used as a seed treatment, especially on wheat to control the fungal disease, bunt. HCB is an animal carcinogen and is considered a probable human carcinogen. After its introduction as a fungicide in 1945, for crop seeds, this toxic chemical was found in all food types. Chronic oral exposure in humans has been shown to give rise to a liver disease, skin lesions with discoloration, ulceration, photosensitivity, thyroid defects, bone defects and loss of hair. Neurological changes have been reported in rodents exposed to HCB. It may cause embryolethality and teratogenic effects. Human and animal studies have demonstrated that HCB crosses the placenta to accumulate in foetal tissues, and it is transferred in breast milk. HCB is very toxic to aquatic organisms. It may cause long-term adverse effects in the aquatic environment. Therefore, release into waterways should be avoided. It is persistent in the environment. Ecological investigations have found that biomagnification up the food chain does occur. HCB has a half-life in the soil of between 3 and 6 years. Risk of bioaccumulation in aquatic species is high.

- **Lindane (gamma-HCH) and alpha- and beta-HCH:** Technical HCH and lindane (gamma-HCH) was one of most used pesticides in history. The technical mixture of HCH contained mainly five isomers (alpha-, beta-, gamma-, delta- and epsilon-HCH). Lindane is the common name for the gamma isomer of HCH and is the only isomer with insecticidal properties. The use of technical HCH as insecticides was phased out decades ago but the use of lindane continues. Lindane has specific exemption for human health pharmaceuticals for the control of head lice and scabies as a second line treatment. Since for each tonne of lindane produced, around 6-10 tonnes of alpha- and beta-HCH were produced as by-products, large waste-HCH stockpiles with associated contaminated sites were generated around production sites.[55] Alpha- and beta-HCH are highly persistent in water in colder regions and bioaccumulate and biomagnify in biota and food webs. They are classified as potentially carcinogenic to humans and adversely affect wildlife and human health in contaminated regions.
- **Mirex** is a chlorinated hydrocarbon that was commercialised as an insecticide. This white crystalline odourless solid is a derivative of cyclopentadiene. It was popularised to control fire ants, but by virtue of its chemical robustness and lipophilicity, it was recognised as a bioaccumulative pollutant. Mirex is only moderately toxic in single-dose animal studies. It can enter the body via inhalation, ingestion, and via the skin. The most sensitive effects of repeated exposure in animals are principally associated with the liver, and these effects have been observed with low doses. At higher dose levels, it is fetotoxic and teratogenic. Mirex was not generally active in short-term tests for genetic activity. There is sufficient evidence of its carcinogenicity in mice and rats. Delayed onset of toxic effects and mortality is typical of mirex poisoning. Mirex is toxic for a range of aquatic organisms, with crustacea being particularly sensitive. Mirex induces pervasive chronic physiological and biochemical disorders in various vertebrates. It can be said that it has carcinogenic risk to humans. Data on human health effects do not exist.
- **Pentachlorobenzene (PeCB)** was partly used as pesticide. PeCB was also used as an intermediate in the manufacture of pesticides, particularly the fungicide pentachloronitrobenzene. In the degradation of pentachloronitrobenzene in the environment, PeCB is then formed again.
- **Pentachlorophenol (PCP)** and its salts and esters have been used as herbicide, insecticide, fungicide, algaecide, and disinfectant and as an ingredient in antifouling paint. Major applications were in wood and leather treatment and in agriculture for weed and snail control. PCP was listed with exemption for wood treatment of utility poles and cross-arms. PCP is a probable human carcinogen at long-term exposure to low levels. Such can occur in the workplace and cause damage to the liver, kidneys, blood, and nervous system. Exposure to PCP is also associated with carcinogenic, renal, and neurological effects. Technical PCP is contaminated with PCDDs, and PCDFs and has been a main source of environmental and human contamination with PCDD/Fs.
- **Toxaphene** is a mixture of approximately 200 organic compounds. Toxaphene is usually seen as a yellow to amber waxy solid. It is volatile enough to be transported for long distances through the atmosphere. When inhaled or ingested, sufficient quantities of toxaphene can damage the lungs, nervous system, and kidneys, and may cause death. It is classified as carcinogen.
- **Sulfluramid** (N-ethylperfluorooctansulphonamid; N-EtFOSA) was first registered in 1989 as an alternative to mirex. Sulfluramid is mainly used in Latin America for managing leaf-cutting ants.[56] Sulfluramid transform to PFOS, a globally distributed environmental contaminant and POP (see 2.3.6). Exposure to PFOS has been linked to weight loss, reductions in serum cholesterol and thyroid hormones as well as hepatotoxic and carcinogenic effects in lab animals and humans.

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[55] Vijgen J, Abhilash PC, Li Y-F, et al. (2011) HCH as new SC POPs – a global perspective on the management of Lindane and its waste isomers. Env Sci Pollut Res. 18, 152-162.

[56] Löfstedt Gilljam J, Leonel J, Cousins IT, Benskin JP (2015) Is Ongoing Sulfluramid Use in South America a Significant Source of PFOS? Production Inventories, Environmental Fate, and Local Occurrence. Environ Sci Technol. 50, 653-659.

#### 2.3.1.2. Production

Suriname does not have facilities to produce pesticides. Unofficially, LVV is aware that several companies are blending chemicals; however, these are not the companies that import pesticides.

#### 2.3.1.3. Import

Suriname mainly imports pesticides for controlling pest and diseases in the agricultural industry. Private companies that are specifically focused on the agricultural sector import these pesticides. Household insecticides are also imported — although to a smaller extent than the agricultural pesticides. The official import data is maintained by HI&T as the main entry point of pesticides. LVV maintains a detailed record on types and quantities of pesticides imported (Table 10). However, there are discrepancies between the data of these two ministries because importers, amongst others, code pesticides in different categories when obtaining their license from HI&T. LVV grants permits for the import of pesticides and HI&T executes the physical aspects of import.

Pesticides enter the country through three major ports in the country; the harbour in Paramaribo, the harbour in district Nickerie (approximately 250 km West of the capital city of Paramaribo), and the International Johan Adolf Pengel Airport (approximately 40 km South of Paramaribo). When pesticides enter via the harbours they are subjected to Custom Control. Both harbours have a permanent office of Customs that practice a well-established procedure where importers need to have a license before physically moving goods from the boat into the country. However, importers often do not follow the procedures and they request permits when pesticides have already arrived at the harbour. Customs at the airport do random surveillance, picking out travellers and checking their luggage to ensure that pesticides are not being transported. Currently, LVV has a group of Port Health Inspectors in training to conduct inspections at the airport. A group is already working at the Zorg en Hoop Airport in Paramaribo, though this port is not known for pesticide trade. These Port Health Inspectors work closely with the Customs Officers, to prevent the transport of pests, pesticides, etc., via luggage.

Prior to 1990, all types of pesticides were imported based on authorisation from LVV. However, POPs such as DDT and endrin were not approved for import. After 1990, the Government made a serious effort to ban pesticides that were identified as dangerous to human health and the environment. As such, in 1999, the import of chemicals banned under the RC, including aldrin, chlordane, DDT, dieldrin, endrin mirex, toxaphene, heptachlor, and HCB were prohibited, representing nine pesticides out of the 12 POPs listed under the SC.

In 2005, the Government prohibited the import of the ODS and methyl bromide by adding this to the State Order Negative List of goods that require license and/or special treatment. LVV also discontinued the import of the following pesticides in 2006; these pesticides are prohibited by Pesticide Decree April 16, 2012: Carbofuran, dimethoate, methamidophos, Wolman salts, and endrin.

LVV denies import requests for the following active ingredients/pesticides: Dimefluthrin and the isomers, e.g. meperfluthrin and metofluthrin (for mosquito coils), bromoxynil (herbicide), acephate (insecticide), oxamyl (fumigant), biorat (based on Salmonella bacteria), diquat and dicofol. Also, in 2014 the PFOS precursor, sulfluramid was banned. An overview on banned POPs pesticides and other pesticides is listed in Table 8. From the POPs pesticides only chlordecone and PeCB have not yet been banned.

*Table 8.Banned POPs pesticides and other pesticides*

| Type | Banned pesticides |
|---|---|
| POPs Pesticides | Aldrin, chlordane, DDT, dieldrin, endosulfan, mirex, heptachlor, hexachlorobenzene, HCHs, lindane, PCP, toxaphene, sulfluramid |
| Other pesticides | 2,4,5-T, binapacryl, captafol, chlordan, chlordimeform, chlorobenzilate, dinitro-ortho-cresol = DNOC, dinoseb, 1,2-dibromoethane = EDB, ethylene dichloride, ethylene oxide, fluoroacetamide, HCB, mercury compounds, monocrotophos, parathion, combination or benomyl <7%, carbofuran <10%; thiram <15%. methamidophos <60%, phosphamidon, methyl-parathion, tributyltin compounds, alachlor, aldicarb, methyl bromide, Wolman salts |

However, Suriname still has considerable import of pesticides. An overview on the import of pesticides according to the different use categories is given in Table 9 below.

*Table 9. Import of pesticides to Suriname from 2009-2015*[57]

Overzicht import bestrijdingsmiddelen
in kg/liter
1993-2015

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| insecticides | 190,109.00 | 152,330.00 | 140,193.00 | 81,807.00 | 165,654.00 | 91,156.00 | 55,141.00 | 196,271.00 | 172,027.00 | 268,103.88 | 252,788.77 | 166,794.28 |
| herbicides | 222,611.00 | 102,717.10 | 123,420.00 | 197,429.80 | 178,114.00 | 136,735.00 | 158,311.00 | 229,926.00 | 262,619.00 | 264,099.92 | 483,374.29 | 491,722.00 |
| fungicides | 90,463.00 | 31,102.00 | 107,067.00 | 15,469.50 | 38,223.00 | 41,579.00 | 1,102,270.00 | 58,204.00 | 57,423.00 | 37,329.08 | 13,969.09 | 36,838.70 |
| nematicides | | | | | 90.00 | | | | | | 12.00 | |
| acaricides | 1,080.00 | | | 132.00 | 36.00 | 270.00 | | | 500.00 | 465.00 | 6.00 | |
| rodenticides | 5,050.00 | 7.00 | 5,624.00 | 5,153.50 | 7,384.00 | 6,659.00 | 8,484.00 | 7,850.00 | 5,720.00 | 9,300.00 | 3,374.05 | 9,883.20 |
| molluscides | 7,787.00 | 22,970.00 | 27,000.00 | 20,350.00 | 17,790.00 | 15,500.00 | 5,611.00 | 22,045.00 | 10,550.00 | 14,970.00 | 34,000.00 | 1,000.00 |
| algicides | | 4.80 | | | | | | | | | | |
| househould insecti | 30,813.00 | 32,338.00 | 87,982.00 | 520,815.00 | 294,687.00 | 964,705.00 | 130,728.00 | 144,888.00 | 486,956.00 | 108,145.80 | 590,190.43 | 237,334.60 |
| totaal | 517,100.00 | 309,130.90 | 403,304.00 | 320,341.80 | 407,291.00 | 291,899.00 | 1,329,817.00 | 514,296.00 | 508,839.00 | 594,267.88 | 787,524.20 | 706,238.18 |

| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| insecticides | 180,597.59 | 198,624.88 | 137,588.04 | 140,249.45 | 243,680.44 | 244,679.37 | 213,252.92 | 351,003.40 | 73,144.77 | 249,675.73 | 234893 |
| herbicides | 526,856.49 | 428,579.63 | 512,254.80 | 654,373.67 | 728,869.22 | 705,929.31 | 681,276.80 | 461,205.20 | 277,234.00 | 716,039.30 | 782792 |
| fungicides | 35,895.19 | 121,446.80 | 104,159.50 | 94,963.20 | 337,381.86 | 429,005.39 | 684,409.56 | 474,349.65 | 447,390.80 | 415,911.36 | 746674 |
| nematicides | | | | | | | | | | | |
| acaricides | | | | | | | | | | | |
| rodenticides | 12,981.11 | 7,100.00 | 24,250.40 | 11,155.00 | 15,574.86 | 10,961.17 | 8,257.00 | 1,424.70 | 3,511.55 | 13,020.00 | 30196 |
| molluscides | 29,163.56 | 25,500.00 | 30,020.00 | 25,000.00 | 23,500.40 | 30,980.00 | 15,000.00 | 3,141.25 | 5,195.60 | 20,250.00 | 23600 |
| algicides | | | | | | | | | | | |
| househould insecti | 219,340.29 | 401,228.58 | 254,508.69 | 259,507.04 | 262,031.25 | 343,263.30 | 391,438.21 | 273,153.05 | 203,701.41 | 290,431.10 | 362314.7 |
| totaal | 785,493.94 | 781,251.31 | 808,272.74 | 925,741.32 | 1,349,006.78 | 1,421,555.24 | 1,602,196.28 | 1,291,124.20 | 806,476.72 | 1,414,896.39 | 1,818,155.00 |

*Source: LVV*

[57] All figures are rounded up.

#### 2.3.1.4. Export

HI&T grants permits for the export of pesticides. Suriname exports pesticides according to the data of the Customs Department of FIN. The export amounts are given in Table 10. However, the data is insufficient to give a specification based on type of pesticide. Although Suriname is not a producer of pesticides, almost 10 % of the imported pesticides are exported.

*Table 10. Export of pesticides in Suriname between the years 2013-2017*[57]

| Pesticides | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|
| Export amount (kg) | 237,572 | 245,223 | 207,267 | 469,343 | 469,272 |

*Source: LVV and Customs Department*

#### 2.3.1.5. Registration

When a license for import has been granted by LVV, pesticides are also required to be registered with HI&T upon entry into the country and are registered at LVV. The registration system is based on the Caribbean Community (CARICOM) External Tariffs list. The Custom Department registration system categorises trade of goods and does not specify the type of pesticides and its future use. Distributors and sellers are not obliged to register buyers or what quantity of pesticides is sold. However, LVV is working on legislation on storage and sale of pesticides. It is planned that retailers must do registration script of what pesticides were sold, to whom, and for what purpose.

#### 2.3.1.6. Release

Once imported, pesticides are only released if they possess a label in the national language (Dutch) that includes the trade name, active substance(s), type of pesticide, toxicity, hazardous symbol, and instructions for use and disposal. LVV is working with HI&T to collaboratively monitor importers to ensure that labels are placed on pesticide containers as required by law.

Pesticides and other chemicals require special care during handling; consequently, their release from the point of entry may include special instructions for transportation. In this regard, HI&T requests assistance from NIMOS, as this institution has developed guidelines for the storage of chemicals. LVV is working on a training workshop with Customs Officers and Extension Workers to help them recognise pesticides, the dangers of pesticides and the different Conventions (BC, RC and SC) that deals with pesticides. The situation will further improve when the legislation on storage and sale is enforced.

#### 2.3.1.7. Use

The use of most POPs pesticides is prohibited in Suriname and no POPs pesticide is registered or currently applied (see Table 8). The most recent restriction was for the PFOS precursor sulfluramid in 2014. Some PCP-treated wood is likely still in use. However, the most commonly used treated wood is Wolman salt.

In Suriname large quantities of DDT (see 2.3.5) as well as PCP was used in the past. PCP was used for the treatment of timber/wood; however, the major wood preservative used in Suriname was Wolman salt. PCP has been used from the 1950s to the 1970s in rice fields for snail control. It was also used in swamps against snails. From 1964 through the 1970s, the PCP was applied to a large extent via aircraft spray operations. Sodium PCP and PCP was used to treat wood in the 60s up until the 80s and sometimes in combination with Lindane. Furthermore, PCP was used until the beginning of the 80s to impregnate wooden window frames and as a component in anti-mildew paint. PCP and 2, 4, 5-T was used at interior locations in Suriname at several wood treatment sites, and possibly other applications, until the 80s. Sodium PCP has not been used officially since the 90s after being placed on the black list.

The various wood treatment sites are considered contaminated with PCDD/Fs (see Section 2.3).

Former use of DDT is reflected in human milk. In the 2013 assessment of human milk from Suriname in the WHO laboratory, only DDT had levels above 1000 ng/g fat (1392 ng/g) and beta-HCH had a concentration of 17.9 ng/g from all POPs pesticides. All other POPs pesticides were below 5 ng/g fat indicating a minor relevance to human exposure in Suriname. The PCDD/F pattern in the human milk showed a congener fingerprint of PCP, demonstrating that the former use of PCP in the past still has an impact on PCDD/Fs. This legacy largely stems from the use of PCP on more than 35,000 hectares of rice fields mainly in the 1960s and earlier with a release of approximately 5565 g TEQ (see Section 2.3.7 on UPOPs).

*Table 11. Restriction of the uses of POPs pesticides in Suriname*

| POP Chemical | Characteristic | Status in Suriname |
|---|---|---|
| Aldrin | Pesticide | Prohibited |
| Chlordane | Pesticide | Prohibited |
| Chlordecone | Pesticide | Not registered or used |
| Dieldrin | Pesticide | Prohibited |
| Endosulfan | Pesticide | Prohibited |
| Heptachlor | Pesticide | Prohibited |
| Hexachlorobenzene | Pesticide | Prohibited |
| Pentachlorobenzene | Pesticide | Not registered or used |
| Mirex | Pesticide | Prohibited |
| Toxaphene | Pesticide | Prohibited |
| Pentachlorophenol | Pesticide | Prohibited |
| DDT | Pesticide | Prohibited |
| Lindane | Pesticide | Prohibited |
| Sulfluramid (PFOS precursor) | Pesticide | Prohibited |

Since 2005, the use of pesticides has almost doubled; however, there are insufficient systems in place to effectively guide safe use. In general, there is insufficient dissemination of risk-related information to transportation companies, salespersons, and users. Also, suppliers and users are not familiar with the procedures of Risk Management. The mixing of pesticides is generally practiced without knowing the specific risks and impacts to human health. However, since the 1990s, there has been a trend towards using environmentally-safer pesticides. Nevertheless, the costs for farmers are relatively high.

Pesticides are predominantly used in the large-scale rice and banana cultivation in the districts of Saramacca and Nickerie, and the smaller-scale vegetables and fruit production operations in the districts of Saramacca, Wanica, and Commewijne. There is inadequate data collection or enforcement on the life cycle and residual effects of pesticides.

The 2005 Pesticide Act provided a framework for safe handling and use of pesticides. However, the support to implement the act is dependent on Government infrastructure which is insufficient. Therefore, the focus of LVV is on raising awareness at the farmers' level and at school. Research about risks associated with the use of pesticides and the dissemination of results to the suppliers and users are limited. The same holds true for the information on the testing of new pesticides before use.

A program on Integrated Pest Management (IPM), implemented by the Caribbean Institute and financed by the GEF-SGP and the ALCOA foundation, has been initiated by LVV. This Project "*Promotion of Organic Agriculture: the Answer to Land Degradation and POPs for the Farmers in the District of Saramacca*", introduced organic cultivation and biological pest-control so that fertilisers and synthetic pesticides are no longer used. Farmers have been trained several years to make a shift to organic farming. In addition, the Caribbean Institute, in collaboration with the “Agriculture Cooperation Safe Food,” publishes an Agriculture paper called “Wroko Nanga Koni” (meaning: “Work Smart”).

The IPM programme is focused on prevention, observation, and intervention. It is an ecological approach with its main goal of significantly reducing or eliminating the use of pesticides while at the same time managing pest populations at an acceptable level. Several farmers are implementing IPM at different levels. Although the Caribbean Institute still functions on a low profile in Mariënburg, a place in the district of Commewijne, East of Paramaribo, this program has stopped for LVV. There is also a new IDB project which started in January 2018. All tests are done at the ministry’s own testing station at Saramacca (Dirkshoop, Tijgerkreek and La Poule) in 5 vegetable crops and minor fruits with farmers.

#### 2.3.1.8. Future use of pesticides

The main goal of IPM programmes and other similar programmes of LVV, is to reduce the dependence on pesticides and artificial fertilisers in the production of agricultural products. If alternatives are cheaper and environmentally-friendly, the use of pesticides will decrease. The promotion of agricultural farming is a major approach of environmentally-friendly agriculture (www.ifoam.bio) and more incentives would be needed.

STAATSOLIE N.V. (State Oil Company) plans to convert circa 12,000 ha from a former agricultural cultivation area of Wageningen into a sugarcane-based biofuel operation. Assessment of soil, sediment and groundwater are being conducted as baseline site assessment. Large-scale agricultural production needs pesticides and fertilisers to a certain extent. It is a challenge for the producers and competent authorities to work together to minimise the use of pesticides and fertilisers in this future large-scale sugar cane production. Also, other multinational companies showed interest in the production of biofuels. This might lead to increased interest in importing pesticides.

LVV is working on an initiative where the farmers can be trained in the use of pesticides. The training would be free, but there would be a fee associated with a certificate and a license. With their license they can go to the registered farmer shops and buy their pesticides. Pesticides retailers would have to follow the same training. The license would have to be renewed every 5 years by taking a refresher course.

#### 2.3.1.9. Storage

Currently, a central storage place is not in place; individual wholesalers and users store pesticides. The 2005 Pesticide Act outlines the requirements for storage, with specific focus on the labelling and handling of containers and specifications for the storage area. The wholesaler and user are responsible for ensuring safe storage of pesticides.

A draft legislation of sale and storage of pesticides has already been written and sent for approval to the DNA. The legislation contains all the requirements needed for storage and sale e.g. vendors must have an agricultural background or must have the necessary training to help farmers to make good choices when purchasing pesticides. Also, farmers must be registered. This system would allow for the monitoring and use of pesticides in the different districts.

#### 2.3.1.10. Management

A monitoring system for residue measurement in plants and animals is currently being established within LVV. Laboratory personnel are being trained and the laboratory facilities for residue measurement need rehabilitation. VG analyses residues in products that can be dangerous to consumer’s health through its Central Laboratory.

Considering high imports of pesticides, a Pesticide Stock Management System (PSMS) has been developed for the Group of Pesticides Control Boards of the Caribbean (CGPC).

Suriname is currently participating in the FAO project "*Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean (2015-2019*)". Under Component 3 of this project, Management of empty pesticide containers, an inventory of all pesticides imported during 2014-2015 (including weight of the packing material) was conducted. A Knowledge, Attitude and Practices (KAP) survey will be held before the restart of the Triple Rinse Awareness programme. The previous program from 2010 was discontinued after a pilot test showed that the shredded containers still contained significant traces of pesticides. LVV is working with stakeholders (importers, recycling companies and NIMOS) to set up a management system. If the empty packing material cannot be processed in the country, then the materials would be shipped to another country with recycling capabilities (Brazil). However, a feasibility study must be done before this course of action.

For component 4, (strengthening the regulatory framework and institutional capacity for sound management of pesticides) preparations are in place for the installation of a Pesticide Board to advise LVV on the pesticide imports. The suggested composition is VG, HI&T, LVV, the importers, the farmers, the pharmaceutical companies and NIMOS.

Suriname also wants to contribute to component 5 of this project for promoting alternatives to chemical pesticides and providing information on traditional alternatives. Only two countries can participate, but before this happens a KAP survey must be held. Additionally, a Risk Reduction Plan must be developed, and the information of alternatives must be collected and collated. After alternatives have been selected, a strategy for field-testing will be determined. The information on successfully tested alternatives will be disseminated using a specially developed Communication Strategy. A final KAP survey will be conducted to monitor the impact of the Communication Strategy and the extent and uptake of the alternatives.

There is currently no specific management of chemically-treated waste wood; it is partly disposed in legal and illegal dumping sites and partly used for cooking or smoking food.

#### 2.3.1.11. Disposal

The Pesticide Act specifies that disposal of pesticides or pesticide-containing materials may not harm the environment and that specific regulations may be given for disposal. All obsolete pesticides that were included during the first NIP 2010 (96.4 tonnes) have been repacked and shipped off to the UK for incineration under component 1 of the abovementioned FAO project "*Disposal of Obsolete Pesticides including POPs, Promotion of Alternatives and Strengthening Pesticides Management in the Caribbean (2015-2019)*". In 2010, the information on the stocks were uploaded on the FAO PSMS website. In total, 22 sites were assessed.

In 2016, desk and field studies of LVV and NCCR showed that there were high direct risks to the environment and human health, around 1,600 – 1,800 litres of obsolete pesticide were repacked in 9 polyethylene (PE) barrels at the Tijgerkreek site in the district Saramacca. The amount of obsolete pesticides gathered from the storages and disposed of, is compiled in Table 12 below. The management of the waste stock pesticides was done under supervision of Veolia, a company with experience and experts in repacking and shipment of hazardous materials.

In the second component of the aforementioned project, Suriname will assess pesticide-contaminated sites. Soil samples were taken and have been sent to the University of the West Indies' (UWI) laboratory.

*Table 12: Obsolete pesticides (tonnes) repacked and shipped off for incineration in 2010*

| Location | Amount (tonnes) |
|---|---|
| Airstrip Wageningen (Sky Farmers) | 13.5 |
| Fai Nickerie | 21.4 |
| LVV /combination Tijgerkreek, Albatros, Berwijn, Peperpot | 18.0 |
| LVV/combination Oryza, Fai Nickerie and airfield Wageningen | 12.6 |
| Fai Saramacca | 17.9 |
| VG/BOG)/ Fai Nickerie | 13.0 |
| **Total** | **96.4** |

#### 2.3.1.12. Potential Impacts

There is limited information about the negative impacts of pesticides on the environment, and safety and health risks. Moreover, the impacts involved with import, storage, transport, distribution, use, handling and disposal of chemicals at different levels within the society are limited. In the two agricultural districts, districts of Nickerie and Saramacca, there are high suicide rates with the use of agro-chemicals/pesticides. The most urgent measure that was identified was proper storage of pesticides in locked cabinets with the key held by the proprietor[58]. LVV started an awareness project with NGOs and relevant institutions such as the Anne van Dijk Rice Research Centre Nickerie (ADRON). The focus is on introducing the 'storage' project where pesticides are put into locked storage compartments.

## *2.3.2. Assessment of PCBs (Annex A, Part II) and PCNs (Annex A, Part I)*

#### 2.3.2.1. General

**Polychlorinated Biphenyls (PCBs)** are a class of chlorinated aromatic compounds with 2 to 10 chlorine atoms substituted to a biphenyl (a molecule composed of two benzene rings). The chemical formula for PCB is C12H10-xClx. PCB's are man-made chemicals; they are not flammable, have high electrical resistance, and possess good insulating properties.

PCBs were widely used for many applications, especially as dielectric fluids—in transformers, capacitors, and coolants—but also in open applications like sealants, paints, plastic additives, or non-carbon copy paper. PCBs are carcinogens (category 1) and some congeners have dioxin-like activity. Further toxic effects associated with PCB congeners are endocrine disruption and neurotoxicity. Approximately 1.3 to 2 million tonnes of PCBs were manufactured over the period 1930 to 1993; half of which were produced by Monsanto, mainly in the USA.

In a recent global inventory, it was estimated that c. 14 million tonnes of contaminated equipment (transformer, capacitor) and contaminated oils exist.[59] With treatment costs of US$ 1,000 to 5000 per tonne[60] (including packing, transport, and destruction), this would amount to an estimated global management cost of US$ 14 to 70 billion to manage the remaining equipment and contaminated oil. The original PCB producers are currently not stakeholders in the financing of PCB waste management.

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[58] Graafsma T., e.a. Research Trends, High rates of suicides and attempted suicide using pesticides in Nickerie, Suriname, South America, 2006.

[59] UNEP (2016) Consolidated Assessment of Efforts made towards the elimination of polychlorinated biphenyls. UNEP/DTIE CHEMICALS AND WASTE BRANCH, January 2016.

[60] Stockholm Convention (2010) PCB Elimination Network Magazine, Issue 1, pp. 12 (12/2010).

**Polychlorinated Naphthalenes (PCNs)** are a class of chlorinated aromatic compounds with 2 to 8 chlorine atoms substituted to Naphthalene. The chemical formula for PCN is C10H8-xClx. PCNs are man-made chemicals; they are non-flammable, have high electrical resistance, and possess good insulating properties.

PCNs have been used in the same applications as PCBs including closed applications (capacitors, transformers) and open applications (e.g. paints, coatings, sealants, flame retardants in cables).[61] However, PCNs were mainly produced/used from 1930 to 1960 with lower productions in the 1970s and production was stopped around the year 2000. Furthermore, the historic production volume was only about 10 % of PCBs (150,000 tonnes versus 1.5 million tonnes). PCNs are also unintentional POPs (see Section 2.3.7) present in technical PCBs at concentrations between 39 to 1300 mg/kg.[61] Therefore, stocks and waste of PCNs can be addressed within the management of PCBs and therefore are addressed together with PCBs here. Also, BC has included PCNs into the technical guidelines for managing PCBs.[62] While the low POPs content for PCBs has been set at 50 mg/kg (ppm), the low POPs content for PCNs were set at 10 mg/kg which need to be considered in the management.[62]

#### 2.3.2.2. Import

PCB-containing materials, such as insulating oils for electrical devices, hydraulic oils, paints, etc., have been imported in the past into Suriname. These equipment and materials might also partly have contained PCNs. Most PCB-containing or contaminated equipment can be found in the electricity generation sector, which is owned by both public and private companies. Transformers currently being imported do not contain PCB or PCNs. The cut-off year for importation of PCB-free equipment by N.V.EBS is suspected to be around the late 80s and the beginning of the 90s while for PCNs this was even earlier.

Currently, the import of PCB- or PCN-containing materials is not prohibited. A permit of HI&T is required for the import of PCB-containing equipment. HI&T issues all permits for imported/exported goods, but it is the Custom Department that registers the actual imports/exports by making use of the Harmonised System (HS) Codes. The use of these HS Codes was introduced in 1999 after the approval of the *Law for Import Tariffs 1996*, also known as the 'Customs Law'. Nevertheless, the import of mixtures and preparations containing PCBs is facilitated by the HS Codes under 3824.82.00, as specified in the CARICOM External Tariffs 2007.

#### 2.3.2.3. Export

In 2005, the Government of Suriname signed a bilateral agreement for a period of two years with the Ministry of Environment from the Netherlands to facilitate shipments of PCB-waste to the Netherlands. The waste was collected from the Suriname Aluminium Company (SURALCO), a subsidiary bauxite mining company from ALCOA, and, a small part, from the BHP Billiton. The total PCB waste and scrap PCB transformers exported, amounted to one 20 feet and eight 40 feet containers, respectively.

#### 2.3.2.4. Use of transformers and other equipment

Due to the developments over the last 20 years in Suriname, for example, the introduction of mobile telephone systems by three companies/providers, as well as the gold mining companies, it is believed that most of these transformers are new and free of PCBs. As mentioned above, PCB-containing equipment is mostly used for electricity generation and can be found in electrical devices such as transformers and capacitors in particular those produced before the 1990s. According to a list provided by the company, the

[61] Secretariat of the Stockholm Convention (2017) Draft guidance on preparing inventories of polychlorinated naphthalenes (PCNs). Draft March 2017. UNEP/POPS/COP.8/INF/19.

[62] UNEP (2017b) Technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with polychlorinated biphenyls, polychlorinated terphenyls, polychlorinated naphthalenes or polybrominated biphenyls including hexabromobiphenyl. UNEP/CHW.13/6/Add.4.

public-owned electricity generation company, N.V.EBS, alone has 10,784 registered transformers, nation-wide. There are also private companies that possess transformers and capacitors.

N.V.EBS has established policy for the management of PCBs including awareness and a Sound Environmental Management System. Their maintenance is done using PCB-free equipment which can also be considered PCN-free. Procedures regarding safety and PCB waste oil management (handling, storage and destruction) were developed. Labelling of distribution transformers older than 1985 was conducted. Also, monitoring by visual inspection for leaks or oil spots from the transformers is done.

Furthermore, some preliminary screening has started. Within the rapid assessment project 40 transformers have been assessed. In 37 transformers the PCB levels were non-detectable (below 2 mg/kg). Three samples were above 50 mg/kg including 1 transmission transformer (PCB conc. 570 mg/kg), 1 distribution transformer (PCB conc. 164 mg/kg) and 1 waste oil tank with PCB conc. of 53 mg/kg.

N.V.EBS has established a priority list for monitoring of transformers including:

a) 50 waste transformers; and

b) 900 distribution transformers in the electricity network.

These transformers might also contain to a lower share PCNs at least as unintentional contaminant of the PCBs.

In a first assessment of capacitors within the development of the first NIP, no PCB-containing capacitors had been found. In 2016, a component for PCB Management under the GEF # 5558 Regional POPs Project led by the BCRC-Caribbean conducted a rapid regional PCB assessment, which was the basis for the screening of the 40 transformers mentioned above. During the first NIP activities a Dexil L2000 analyser was purchased for monitoring of transformer oils. This equipment is at ADEKUS and can be used after purchase of test kits. In this monitoring approach PCNs would also be detected by the same mechanism.

Although data has not been presented, it is assumed that PCBs in ‘open applications’, such as paints, caulking and hydraulic systems, have been used in the past. Since PCNs and SCCPs have recently been listed as POPs in 2015 and 2017 respectively, these open applications also must be assessed for these POPs.

#### 2.3.2.5. 2.3.2.5 Registration and Control

A permit of HI&T is required for the import of PCB-containing equipment. However, there is no legal instrument that requires mandatory registration and control of PCB-containing materials/equipment that are already in the country. Nevertheless, registration of transformers and capacitors is taking place based on the policies of a few companies. For example, N.V.EBS has a database of all their transformers, and the company also established that untested transformers would not leave N.V.EBS premises. The gold mining company IAMGOLD has labelled their equipment PCB-free and they intend to continue along this path.

#### 2.3.2.6. Storage and Release

There are neither large obsolete stocks nor reserves except for 50 waste transformers. As previously mentioned, transformers and capacitors are the major source of PCB in Suriname. Because a comprehensive inventory has not been completed, it is expected that PCB-contaminated materials as well as contaminated soil or other material with PCB/PCNs exist and might be generated by leaking transformers. Currently such release and contamination are considered small since N.V.EBS assesses their transformers with respect to leaks.

An area that needs consideration for release of PCBs/PCNs into the environment is the newly established recycling industry in Suriname, where scrap metal dealers have the possibility to sell, among others, PCB-contaminated oil transformers or smelt metal scrap. Additionally, there are potentially-contaminated soils at areas where PCB-containing or contaminated transformers were or are operated. Landfills where

PCB/PCN-containing waste has been disposed, including the landfills from SURALCO, might contain and release PCBs/PCNs (although their leaching potential is relatively small).

Currently, there is no interim storage for PCB-containing equipment in Suriname that meets international standards. As such, interim storage will be required, since it is expected that PCB-contaminated equipment will be exported to licensed facilities abroad. This will be necessary, because it is expected that the volume of PCB-contaminated equipment or materials is low, and therefore a national disposal facility for PCBs is not necessary.

The N.V.EBS has a transformer storage facility at their Livorno establishment, where all phased-out transformers from their premises are gathered. The old transformers used by N.V.EBS in the past may contain PCB. A preliminary assessment of the soil quality by ILACO Suriname N.V. and Eurofins Analytico Laboratory in the Netherlands did not detect PCB contamination (<0.5 mg/kg).

Another issue that requires attention is cross-contamination with PCBs during maintenance-activities of transformers. It is therefore important that those who own or perform maintenance activities be made aware of this potential problem. With many of the transformers believed to be new the cross contamination problem is considered low. The N.V. EBS has developed an internal program that informs and raises awareness of its personnel. The aim of the program is to provide information on how to protect the environment and humans while carrying out relevant duties, as well as how to manage transformers, especially those manufactured and installed between 1950 and 1985. The program details information on what PCBs are and their effects on the environment. It includes training on visual inspection according to a checklist, labelling of transformers with yellow (PCB-containing) stickers and blue (PCB-Free) stickers (see Figure 3). For the management of transformers, the N.V. EBS has created areas for transformers that are out-of-order or have broken down plus an area for PCB-waste. Also, an area for transformers that still can be operated and those that require repairs.


*Source: N.V.EBS*

*Figure 3. Stickers used for PCB-free equipment*

#### 2.3.2.7. Potential Impacts

A comprehensive survey of PCB-contaminated sites has only been conducted to a limited extent thus; the national impact cannot be determined. Nevertheless, PCBs when released to the environment can pose a serious threat to food-producing animals and human health.[63] The analysis of a limited number of oil-samples from transformers of both N.V.EBS and STAATSOLIE N.V. indicate that both companies have to take precautionary measures to ensure that impacts on both humans and the environment are preferably eliminated. In this regard, assistance will be required from Government agencies.

[63] Weber R, Herold C, Hollert H, Kamphues J, Ungemach L, Blepp M, Ballschmiter K (2018) Life cycle of PCBs and contamination of the environment and of food products from animal origin. Environ Sci Pollut Res Int. doi: 10.1007/s11356-018-1811-y.

### *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. General

To update the current NIP, an inventory of commercial PentaBDE, commercial OctaBDE, Hexabromobiphenyl and Hexabromocyclododecane, their current use, initial flow, recycling and waste management, storage, and disposal have been conducted in Suriname based on the PBDE and HBCD inventory guidance documents.[64,65]

Polybrominated Diphenyl Ethers (PBDEs) are brominated flame retardants (BFRs) used in various products such as plastic in electronics, polyurethane foams in vehicles and, textiles, to reduce their ignitability to meet certain flammability standards. Due to the increase of flammable polymer materials, the global demand for PBDEs (and other flame retardants) has been growing rapidly from the 1970s to 1990s. This was also partly driven by industry lobby.[66] Three commercial PBDE mixtures were produced and used in the market: commercial PentaBDE, OctaBDE and DecaBDE. However, due to their characteristics of persistence, bioaccumulation potential, long-range environmental transport and adverse effects on wildlife and humans, PBDEs have become ubiquitous environmental contaminants and aroused increasing concern. Appreciable levels of PBDEs have been reported in various environmental media and biota, including water, air, soil, marine mammals and human blood. PBDEs can affect neurodevelopment, neuro-behaviour, and thyroid hormone regulation in exposed animals and individuals.[12,70]

Environmental and health risk of commercial PentaBDE (c-PentaBDE) and commercial OctaBDE (c-OctaBDE) technical mixtures led to the phase-out by restrictions and directives. Production was stopped in 2004. Plastics are important parts of electrical and electronic equipment (EEE) products and PBDEs are widely used as additives in these plastics.

HBCD is another prominent brominated flame retardant used mainly (90 %) in expanded and extruded polystyrene (EPS/XPS) in building insulation. Minor uses were in textiles and in high impact polystyrene (HIPS) in electronics. The challenge is how to practically control PBDE and HBCD in articles and the recycling flows. This is a problem for developing countries like Suriname where state of the art recycling plants with monitoring capacity do not exist and measurement capacity is not established. Suriname (like other developing countries) lack appropriate recycling and destruction facilities which leads to open burning or dumping of such hazardous wastes or release to water bodies causing environmental pollution including marine litter.

Plastic in certain electrical and electronic equipment and related waste (EEE/WEEE) in particular Cathode Ray Tube (CRT) casings are considered to contain the largest share of POP-PBDEs from c-OctaBDE in the material/waste flow.[64] For c-PentaBDE the main use (90 %) was in polyurethane foam with use in car/transport, furniture, construction, mattresses or baby products and a major use in the US.[64]

In Suriname recycling is still under developed. Companies are selling or recycling metals. However much of the plastic/polymers which cannot be sold is not recycled including plastic and polymers from electrical and electronic equipment (EEE) and end-of-life vehicles (ELVs). As a result, most of the plastic/polymers eventually end up in a disposal site (dumpsites) with associated open burning. In this instance it needs to be assured that hazardous chemicals including POPs and other toxic substances including heavy metals are controlled and managed.

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[64] Stockholm Convention (2015) Guidance for the Inventory of commercial Pentabromodiphenyl ether (c-PentaBDE), commercial Octabromodiphenyl ether (c-OctaBDE) and Hexabromobiphenyls (HBB) under the Stockholm Convention on Persistent Organic Pollutants; Draft. UNEP/POPS/COP.7/INF/27.

[65] Stockholm Convention (2015) Guidance for the inventory, identification and substitution of Hexabromocyclododecane (HBCD), Draft March 2015.

[66] http://media.apps.chicagotribune.com/flames/index.html

To control these types of waste, it was important that Suriname carried out a preliminary inventory, which is summarised below and described in the related inventory report. The aim of this inventory was to evaluate the situation in Suriname of the major articles and products in use and stocks and wastes impacted with POP-PBDEs and HBCD. For PBDEs, the inventory mainly focused on electrical and electronic equipment (EEE) and related waste (WEEE) and the transport sector. The methodology used to conduct the inventory was based on the SC inventory guidance documents and included interviews, the use of data from ABS, data from Customs, Trade Map[67] and internet sites.

#### 2.3.3.2. EEE and WEEE containing POP-PBDEs

Plastic in certain EEE/WEEE that is, CRT casings is considered to contain the largest share of POP-PBDEs from c-OctaBDE in the material/waste flow and polyurethane foam in car/transport, furniture, construction, mattresses the main share of c-PentaBDEs. In Suriname, recycling is still under-developed, thus companies are generally not interested in these plastic/polymers since there is no significant value on the market. As a result, most of the plastic/polymers from CRTs eventually end up on a disposal site (dumpsites).

It should be noted that c-DecaBDE was listed in 2017 as POPs and due to the recent listing, it was not part of this inventory. The actual amount of total PBDE is considerably larger than the current estimated POP-PBDE from c-OctaBDE due to the considerably larger amount of DecaBDE used in CRTs and in other EEE plastics. Currently, the quantity of DecaBDE EEE/WEEE plastic cannot be calculated since there is no inventory guidance. Notwithstanding, since the DecaBDE use was approximately 10 times the c-OctaBDE use, the total amount might be an order of magnitude higher. Also, DecaBDE is still produced and has also been used more recently than c-OctaBDE, and c-DecaBDE impacts more recent equipment.

#### 2.3.3.3. Import

Import statistics were available from 2001 to 2016 for EEE and that for the transport sector was available from 1998 to 2016. Some interpolation of data had to be done. Around 2006 Suriname started to import flat screen TVs and by 2015 almost no CRTs were imported. It is assumed that the CRT imported before 2007 have largely ended up in landfills and CRTs imported after 2007 are still largely in use or stored on a private/consumer level.

According to the 2016 inventory, the total plastic imported in CRT units between 2001 and 2016 was estimated at 968.7 tonnes, containing 1,025 kg c-OctaBDE. CRTs have also been imported in the 1960s up until 2000, these quantities are probably 3 to 6 times larger. Old import data were not available.

From 2006, the imports of flat screen TVs/PCs increased sharply with a considerable decrease in CRT imports after 2007 forwards and in 2016 almost no CRT were imported in Suriname. The import of c-OctaBDE in 2016 was estimated to be 0.19 kg containing 0.1 kg POP-PBDEs.

#### 2.3.3.4. Export

Between 2001 and 2016 some e-waste export took place. It was estimated that with the exported CRT casings approximately 257 kg of c-OctaBDE (129 kg POP-PBDE) have been exported.

#### 2.3.3.5. Use/storage

The CRT units imported in the period 2007 – 2016 are largely considered to be still in use and stocked. The total amount of plastic of CRTs in use or stocked is estimated to be 87.8 tonnes, containing 129 kg c-OctaBDE (containing 70 kg POP-PBDEs).

[67] Trade Map provides indicators on export performance https://www.trademap.org/

#### 2.3.3.6. End-of-life

No e-waste management has been established in Suriname - a large part of the waste EEE (WEEE) is stored or dumped. It is assumed that the CRT imported in 2006 and earlier have largely ended in landfills and CRTs imported in 2007 and later are largely still in use or stored on a private/consumer level. Based on this assumption it is estimated that the CRTs units imported in the period 2001-2006 (881 tonnes) have already largely ended in the landfills containing 896 kg c-OctaBDE (480 kg POP-PBDEs). The total volume of disposed CRTs is, however, probably 3 to 6 times larger considering the above-mentioned imports from 1960s to 2000 which have largely entered end-of-life.

#### 2.3.3.7. Current generation of CRTs in WEEE

For 2016 it was estimated that approximately 65 tonnes of CRT plastic containing 65 kg c-OctaBDE (35 kg POP-PBDE) entered WEEE stream.

#### 2.3.3.8. Transport sector

c-PentaBDE (containing tetraBDE, pentaBDE, hexaBDE and heptaBDE) has partly been used in Polyurethane foam in seats or head rest in cars, trucks and other vehicles. For the transport sector import data were available from 1998 – 2016. Some interpolation was done for the few years where import data were not available. Data on registration of vehicles were available from 1990.

#### 2.3.3.9. Import

The total amount of POP-PBDE in imported cars, buses and trucks and imported between 1998 and 2013 were estimated to be 768 kg, 188 kg and 76 kg and therefore a total of 1,032 kg POP-PBDE. The total number of historically imported vehicles can be roughly estimated by the number of imported vehicles from 1998 to 2016 (1,032.5 kg), which includes the registered vehicles in 1998. The registered vehicles in 1998 were 55,350 cars, 2,108 buses and 18,709 trucks containing an estimated total of 656 kg POP-PBDE. Based on this a total historic amount of imported POP-PBDEs in vehicles to Suriname can be estimated to 1,688 kg.

#### 2.3.3.10. Use/storage

The amount of POP-PBDE in current stocks was calculated by the amount of current registered vehicles produced before 2005. The total amount of POP-PBDEs in these registered vehicles was estimated to 620 kg mainly from cars (442 kg) and less from trucks (121 kg) and buses (58 kg).

#### 2.3.3.11. End-of-life vehicles

The total amount of POP-PBDE in vehicles having entered end-of-life is estimated to be 1,067 kg POP-PBDEs. According to scrap dealers the interior such as seats, dashboards, etc. must be taken out for export. These polymers together with polyurethane foam containing PBDE (and other flame retardants) are mainly dumped and partly open burnt. Minor reuse of car seats and plastic parts occurs. Some of these cars have not finally entered end-of-life with scrapping but are stored in garage and backyards without registration. A reasonable estimate of these stocked cars could not be made in this inventory but needs further assessment.

#### 2.3.3.12. Total amount of polymers in vehicles

The PBDEs are contained in the polymer fraction. Therefore, the task is the management of the polymer fraction of vehicles. These polymers largely end in landfills where there is a large possibility to undergo open burning. Furthermore, polymers including plastic and foams are a major part of marine litter, which heavily impact marine health and consequently human health. The total amount of all polymers (plastic, foam and synthetics like textiles) present in cars in current use in 2015 was 29,200 tonnes. Additionally, trucks and minibuses contained 6,887 tonnes and 1,443 tonnes of polymers respectively. In addition to PentaBDE, some of the polymers and textiles contain DecaBDE and HBCD, which were more recently listed as POPs.[68]

#### 2.3.3.13. POP-PBDE in other articles/products

Due to the lack of flammability standards for furniture and construction, POP-PBDE has most likely not been used in these articles/products in Suriname. However, POP-PBDE was used as flame retardants in Polyurethane foam in furniture (sofas, seat etc.) in the US where furniture is partly imported. The amount of furniture imported since 1996 from the US was compiled. In this preliminary inventory details of types of furniture and estimated amount of POP-PBDE could however not be estimated.

#### 2.3.3.14. Inventory of HBCD

**a) Production and use**

HBCD is still produced and used in expanded and extruded Polystyrene (EPS/XPS) foam. Suriname has no industry for the production and use of HBCD in its chemical form. The country imports consumer products that contain HBCD such as EPS/XPS foam for insulation material and possibly flame retarded textiles produced before 2013.

**b) Inventory of HBCD in polystyrene (EPS and XPS) in current use and stock**

*Inventory of HBCD in EPS/XPS in construction (major use)*

Data about construction material was gathered from ABS. This insulation material does not include EPS/ XPS (HS code: 39211900 / 39211200 / 39219000). Data of import of insulation materials is documented from 2010 to the present. No data were available from 1996 – 2009. Data could be gathered about insulation material containing EPS and XPS from Trade Map[69]. The information gathered included the amount of (potentially) HBCD containing XPS and EPS currently used in new buildings and construction for the inventory year 2016. It also included the total amount of HBCD in current EPS/XPS use/stockpile in buildings and construction (considering that the use of HBCD in EPS and XPS started in 2009 based on the available data).

The total amount of HBCD in XPS and EPS was calculated by using the total volume of EPS in construction and the related HBCD content (0.5 to 0.7%) and the total volume of XPS in construction and the related HBCD content (0.8 to 2.5 %) (Guidance manual). From 2009 to 2014 a total of 1,983 tonne of EPS and 344 tonnes of XPS has been imported to Suriname. Considering an average impact of 0.5 % HBCD in EPS, 9.9 tonnes of HBCD might be in stock (in construction). For XPS an average impact of 2 % was assumed with an estimated 6.88 tonnes in construction. This can be considered as an upper limit estimation since during the inventory no certified information could be obtained if or what share HBCD has been used in these imported EPS/XPS. Therefore, further assessment is needed for this sector.

*Assessment and inventory of end-of-life management from EPS and XPS*

The amount of HBCD-treated EPS/XPS foam in the end-of-life management would include the amount of EPS/XPS from demolishing and refurbishing buildings as well as waste from new constructions and insulations. Considering the current stock of EPS/XPS in buildings and a use of 30 to 50 years only minor amounts of EPS/ XPS will enter the waste stream in the short term.

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[68] Kajiwara et al. (2014) Brominated flame retardants and related substances in the interior materials and cabin dusts of end-of-life vehicles collected in Japan. Organohalogen Compd 76, 1022–1025.

[69] The Trade Map platform provides indicators on export performance https://www.trademap.org/Index.aspx

*Inventory of HBCD in EPS/XPS in packaging (minor)*

No specific information was available on EPS packaging materials. HBCD is normally not used in packaging and is considered of minor relevance.

**c) Inventory of HBCD in textiles**

*HBCD in clothing*

No specific information is available for HBCD in textiles. Uniforms for fire brigade or military might be impacted. Information would need a Tier 3 inventory with screening and measurements.

#### 2.3.3.15. Inventory of HBCD in EPS/XPS in other uses (minor: mattresses)

Suriname has no specific flammability standards for furniture/mattresses, but these materials are also imported from the USA having specific flammability standards.

#### 2.3.3.16. Potential Impacts

Exposure to PBDEs and HBCD occur along the life cycle of the products and materials.[70] In particular c-Penta-treated polyurethane foam in vehicles or furniture or recycled materials can result in high exposure.[71] The exposure to PBDEs from WEEE plastic is lower with e.g. lower levels of PBDE in recyclers from BAT e-waste recycling facilities.[72] Also, the exposure from HBCD in polystyrene is considered low while HBCD in textiles might have a higher exposure risk from fibres and related house dust ingestion.

Of high concern is the open burning of PBDE and HBCD-containing waste. The smouldering of e-waste and cables can result in contaminated sites (see below 2.3.8).

### *2.3.4. Assessment of Hexachlorobutadiene (HCBD) (Annex A, Part I)*

#### 2.3.4.1. General

HCBD has been listed in Annex A and C of the SC. Like all POPs, HCBD has toxic properties, especially for aquatic organisms and birds, resists degradation, and bioaccumulates in fatty tissues (UNEP 2011).[73,74,75] HCBD is a relatively volatile and water soluble (3.2 mg/L) POP and therefore can contaminate ground and drinking water in areas were HCBD waste has been disposed.[76]

The most relevant source of HCBD was (and is) the production of chlorinated solvents (Tetrachloro-ethylene/perchloroethylene, trichloroethylene, tetrachloromethane/carbon tetrachloride) and hexa-chlorocyclopentadiene (intermediate of cyclodiene pesticides) and the related waste and landfills from (former) production. The HCBD inventory guidance stresses that Parties that have neither current nor past

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[70] Shaw SD, Blum A, Weber R, Kannan K, Rich D, Lucas D, Koshland CP, Dobraca D, Hanson S, Birnbaum LS. (2010) Halogenated Flame Retardants: Do the Fire Safety Benefits Justify the Risks? Reviews on Environmental Health 25(4) 261-305.

[71] Stapleton HM, Sjödin A, Jones RS, Niehüser S, Zhang Y, Patterson DG Jr (2008) Serum levels of polybrominated diphenyl ethers (PBDEs) in foam recyclers and carpet installers working in the United States. Environ Sci Technol. 42(9):3453-3458.

[72] Thuresson K, Bergman K, Rothenbacher K, Herrmann T, Sjölin S, Hagmar L, Päpke O, Jakobsson K (2006) Polybrominated diphenyl ether exposure to electronics recycling workers--a follow up study. Chemosphere. 64(11), 1855-1861.

[73] UNEP (2011) Proposal to list hexachlorobutadiene in Annexes A, B and/or C to the Stockholm Convention on Persistent Organic Pollutants. UNEP/POPS/POPRC.7/3.

[74] Secretariat of the Stockholm Convention (2017) Draft guidance on preparing inventories of hexachlorobutadiene (HCBD). UNEP/POPS/COP.8/INF/18.

[75] IPCS (1994) International Programme on Chemical Safety, Environmental Health Criteria 156, Hexachlorobutadiene, WHO.

[76] Clark CS, et al (1982) An environmental health survey of drinking water contamination by leachate from a pesticide waste dump in Hardeman County, Tennessee. Arch Environ Health. 37(1), 9-18.

production of relevant organochlorines in their countries are not expected to have major HCBD production, release, stockpiles or contaminated sites, which is true for Suriname. Therefore, such Parties can prepare inventories that are limited to possible imports of HCBD and imports of impacted organochlorines.

#### 2.3.4.2. Production

Suriname does not produce HCBD and has no organochlorine production process where HCBD could be generated at levels where HCBD separation for intentional production is possible.

#### 2.3.4.3. Import

Suriname does not import HCBD as products. Minor amounts of unintentionally HCBD might be imported in perchloroethylene used for dry cleaning (see section 2.3.7).

#### 2.3.4.4. Export

There is no export of HCBD.

#### 2.3.4.5. Use

No current intentional use of HCBD has been discovered in Suriname. Since HCBD has been used to a minor extent in transformers or as hydraulic fluid, minor amounts might be in use.

HCBD might have been used in the former aluminium smelter for refining but operation has stopped.

#### 2.3.4.6. End of life management

Waste, which might contain impurities of HCBD, such as waste from dry cleaning using perchloroethylene, is disposed of at dumpsites. Waste oils possibly containing HCBD from former use in hydraulic oils are managed in Suriname but have not been analysed for HCBD impurities. The management of oils from transformers of N.V.EBS have not started but are expected to start within the regional POPs project. HCBD that might be present would be managed within the frame of PCB management and can be detected with the Dexil L2000 analyser which is to be used for assessment of transformers.

Residues from the former aluminium smelter might have contained HCBD. The residues have been disposed in a landfill (without the specific lining) and can be considered a potentially contaminated site.

### *2.3.5. Assessment with respect to DDT (Annex B, Part II)*

#### 2.3.5.1. General

Dichlorodiphenyltrichloroethane (DDT) is one of the well-known synthetic pesticides and was first synthesised in 1874. The chemical structure of DDT is $(ClC_6H_4)_2CH(CCl_3)$. DDT readily binds with fatty tissue in any living organism, and due to its stability, bio-concentrates and bio-magnifies with increasing trophic level in food chains. The half-life of DDT in humans is more than 4 years; the half-life for DDE (Dichlorodiphenyldichloroethylene) is possibly longer. DDT is highly toxic to insects, shrimp and fish, and adversely affects the reproduction of wild birds through thinning of eggshells. The global production of DDT for vector control is estimated at 4,550 tonnes in 2003 and 4,740 tonnes in 2005. In 2007, production increased, with 6,300 tonnes produced in India alone. Data on DDT-use from several countries are not available or need verification. Apart from the Dominican Republic, there is no reported use of DDT for disease vector control from the Americas. Uses in Ecuador, Mexico, and Venezuela were phased out in the year 2000. Over the years, WHO reports have stated that DDT is the most cost effective and time-tested tool for preventing transmission of human malaria.

#### 2.3.5.2. Import

The Government has made a serious effort to ban pesticides which were identified as dangerous for humans and the environment. DDT has not been imported since the beginning of the 80s, and therefore the Government decided in 1981, to bury the then-existing stock. As such, in 1999, the import of DDT chemicals was prohibited under the RC. DDT is prohibited based on the 1999 regulation of HI&T, and the 2005 ban on pesticides by LVV.

#### 2.3.5.3. Export

Since the use was prohibited, no export, registration, and control of DDT have been recorded.

#### 2.3.5.4. Use

Between 1958 and 1982, DDT was used extensively to control malaria in the Interior of the country. In the second part of the 1980s and early 1990s the use of synthetic pyrethroids was gradually introduced, and by the end of the 90s, these insecticides were the only ones imported and used as a malaria vector-control strategy. The main insecticides used were deltamethrin, permethrin, and lambda cyhalothrin. Currently, VG uses Fenitrothion 40% wettable powder formulation (WP).

Suriname has reported that no spraying has been done — although it was one of the most highly malaria-ridden countries of the Americas (PAHO 1994). To control malaria, VG implemented the WHO Global Malaria Programme which resulted in reducing the number of reported malaria deaths that fell from 24 in 2000, to one death in 2009; this can be seen as great success. These achievements are strongly associated with the scaling-up of anti-malaria interventions. The programme has delivered a total of 22,490 long-lasting insecticide-treated mosquito nets (LLINs) during 2007–2009, enough to protect 79 % of the population at high risk. No data were reported on the indoor residual-spraying (IRS) implementation in recent years. Although the programme did not report delivery of Artemisinin-based Combination Therapy (ACT) in 2009, supply has probably been adequate to treat all *P. falciparum* cases. [77] However, because of the high costs of the pyrethroids alternatives, these can only become available through donor projects, which provide funds to purchase these alternatives. It is noteworthy to mention that these alternatives need more frequent spraying, as they are less persistent than DDT. Resistance among mosquitoes against DDT was found.

In February 2011, the Government signed a bilateral agreement with French Guiana to fight against the Aedes Aeqypti mosquito, an insect well known in tropical and sub-tropical climates worldwide. This mosquito may carry the virus that causes the much-feared Dengue fever in humans. This Dengue project is supported by the Agence Française de Développement with the help of the Conseil Général of French Guiana, together with Surinamese counterparts, namely VG. *Bacillus thuringiensis israelensis* (BTI) will be used for the destruction of the mosquito larvae. BTI is a proven, environmentally-safe mosquito larvicide that is non-toxic to people. The product destroys the insect in its larval state and is also effective against adult insects. The objective of this project is to improve health and education services, and infrastructure for the populations of the Marowijne River.

'Kwasibita' (*Quassia amara L.*) is a bitter wood which has been used for decades by the local communities for the prevention and treatment of malaria and fevers. The plant grows in low-lying areas and contains many of the same anti-malarial phytochemicals contained in quinine. By boiling pieces of Quassia wood in water, one obtains a spray effective against many insects. Such popular remedies are used not only in Suriname and Guyana, but also, in Brazil. It is also used as a repellent against mosquitoes.[78]

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[77] World Malaria Report; WHO Global Malaria Programme 2010.

[78] www.quasix.eu/pdf/4-2/Data_Quassia_1.pdf

#### 2.3.5.5. Release and storage

The pesticide stockpiles and wastes containing POPs have been exported for destruction and DDT import and use has stopped. Therefore, there are no storage sites with associated releases. According to the information from the Pesticides Department of LVV, a quantity of DDT and dibrom has been buried in the last quarter of 1981 on a location at the site of the BOG of VG. It was buried together with some old air conditioners at a 2.5 m depth in an area where the groundwater level is circa 2 meters. Circa 550 kg DDT (75 % active substance) and an unknown quantity of dibrom that was stored in leaking drums was buried. It is recommended as part of the NIP that the abovementioned buried DDT and accompanying goods should be recovered, the area cleaned up, as well as the DDT destroyed when funding become available. Until then, the area needed to be marked and secured.

#### 2.3.5.6. Potential impacts

Some studies on the impacts from the use of DDT on malaria were done in the 80s[79]. There is no information on research that has been done on the environmental and health impact of DDT in Suriname. With the exemption of human milk, no environmental and biological samples of DDT were determined. Total DDT amount in human milk analysed in the WHO laboratory (Freiburg/Germany) was 1,392 ng/g fat. Further studies in vulnerable areas with the presence of DDT are needed. Areas of study are the food chain, impacts on human health and (ground) water resources. In relation to the abovementioned buried pesticides it is important to realise that the milk company located nearby uses the groundwater. It is known that the water quality is monitored on a regular basis; however, it is not known whether pesticides-related parameters are analysed.

### *2.3.6. Assessment of PFOS, its salts and PFOSF (Annex B, Part III)*

#### 2.3.6.1. General

Per and polyfluorinated alkylated substances (PFAS) is the collective name for a large group of fluorinated compounds, including oligomers and polymers, which consist of neutral and anionic often surface-active compounds with high thermal, chemical and biological inertness. PFAS are used in many different chemical products and articles because of their desirable properties and as a result they find their way into the environment. The substances have extremely poor environmental biodegradability (persistent, P) and many of them accumulate in living organisms (bio-accumulating, B) and are toxic (T). There is a lack of overall knowledge of highly fluorinated substances and to prevent further pre-existing health and environmental problems from building up and persisting for a long time, it is important to control and where necessary to map out the occurrence and use of these substances[80]. Therefore, PFAS have been listed as an issue of concern under SAICM.

Perfluorooctane sulfonate (PFOS) is one of the most relevant PFASs detected in wildlife and humans worldwide[81,82,83]. Other PFAS are not listed in the SC but perfluorooctanoic acid (PFOA) has been assessed by the POPs Review Committee and will be listed as a POP in 2019. Additionally, Perfluorohexane sulfonic

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[79] For examples: research studies of J.E. Hudson; VG.

[80] Blum A, Balan SA, Scheringer M, Trier X, Goldenman G, Cousins IT, Diamond M, Fletcher T, Higgins C, Lindeman AE, Peaslee G, de Voogt P, Wang Z, Weber R (2015) The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs). Environ Health Perspect 1235 A107–A111.

[81] Kallenborn R, et al. (2004) Perfluorinated alkylated substances (PFAS) in the Nordic environment. TemaNord 2004:552.

[82] Giesy JP; Kannan, K. (2001) Global Distribution of Perfluorooctane Sulfonate in Wildlife. Environ. Sci. Technol. 35, 1339–1342.

[83] Harada K, et al. (2004) The influence of time, sex and geographic factors on levels of perfluorooctane sulfonate and perfluorooctanoate in human serum over the last 25 years. J Occup Health, 46(2), 141-147.

acid (PFHxS) is currently assessed by the POPRC and it has been concluded that it meets the POPs properties.

#### 2.3.6.2. Inventory of PFOS in firefighting foams

The major stocks of PFOS in Suriname are firefighting foams. An inventory of firefighting foams – import, current stocks and major use sites - has been compiled.

Considerable amounts of PFOS and potentially PFOS containing firefighting foams are stored at the headquarters of the military base and small firefighting departments throughout the country. Additionally, STAATSOLIE N.V. has its own stock.

The total amount of all stored firefighting foam in Suriname is estimated to be 275.6 tonnes, where the major stock with 206 tonnes is at the oil storage facilities. For some of these foams PFOS is confirmed. For some of the foams it is not clear if the foam contains PFOS or other per- or polyfluorinated alkylated substances (PFAS).

An upper estimate of all foams containing or potentially containing PFOS has been made, which results in an estimate of 1378 to 2756 kg of PFOS in these foams. Further tier III inventory with measurements is needed to determine the amount of PFOS and other PFAS in some of the foams with unknown content. Also, the foams containing other PFAS need to be managed since also they can contaminate the environment.

*Table 13. Estimated amount of PFOS from firefighting foams for the major user categories in Suriname based on quantity in stock in 2016 and considering that all foams would contain PFOS[84]*

| User category | Quantity of PFOS foam in stockpile (L) | Quantity PFOS foam in stockpiles (kg) | Emission: Low net PFOS content (kg) | Emission: High net PFOS content (kg) |
|---|---|---|---|---|
| Fire Services | 49,520 | 51,001 | 255 | 510 |
| STAATSOLIE N.V. | 18,015 | 18,555 | 93 | 186 |
| Oil storage facilities | 200,000 | 206,000 | 1,030 | 2,060 |
| Firefighting facilities | ND* | ND* | ND* | ND* |
| Aviation | ND* | ND* | ND* | ND* |
| **TOTAL** | **267,535** | **275,556** | **1,378** | **2,756** |

**ND = No data received for this inventory*

#### 2.3.6.3. Inventory of PFOS in other uses

**Sulfluramid (Mirex-S; N-ethyl perfluorooctane sulfonamide) insecticide for ants and termite**

PFOS related substances (sulfluramid) were and are used as insecticide against ants in Suriname since 2006. In total 15,000 kg sulfluramid with 0.5 % PFOS content and therefore 75 kg PFOS has been imported to Suriname in pesticides in the past. This was used against ant infestation in residential, industrial and commercial uses throughout Suriname also in the hinterland. The import was continued until 2014, but the use of sulfluramid as an insecticide is now prohibited. There are likely some stocks in private consumer and at companies.

[84] Therefore, an upper estimate.

**Synthetic carpets, textiles, leather, paper**

In Suriname, synthetic carpets (tufted carpets) are widely used as decorative floor and wall coverings. A visit to major stores in Paramaribo, Wanica, and Para showed that there are stockpiles from around 1990 and above. In synthetic carpets such as nylon, PFOS is chemically bound within a polymer and has been extensively used in this application. Due to the long service live of carpets, they are now considered as relevant PFOS and other PFAS stockpile. The inventory of the major carpet stores showed a total stock of 38,300 $m^2$ of synthetic carpets. A quantitative PFOS inventory for these carpets can, however, only be conducted by a tier III inventory with addition of the measurements of the carpets, since only a proportion of these carpets are treated with PFOS-related substances (mainly those synthetic carpets produced before 2002). Another proportion is treated with other PFAS or do not contain PFAS, which also can only be quantified by measurements. Furthermore, synthetic carpets are used in private housing, hotels and offices. These amounts of carpet could not be assessed in this first national PFOS inventory.

PFOS-treated textiles and paper have shorter life cycles compared to carpets and the PFOS-treated textiles and papers that are produced before 2002 have largely reached their end-of-life and are in landfills and dumpsites with release-potential. The total historic use of PFOS in these applications which have ended in landfills cannot be estimated in this first inventory.

**Aviation hydraulic fluid**

PFOS has been used in aviation hydraulic fluid in airplanes. The assessment of aviation hydraulic fluid in Suriname showed that the used oil (Chevron Aviation Hydraulic Fluid) does not contain PFOS or related substances.

**Chromium plating and other plating**

PFOS was and is still used in the plating industry and several countries have asked for exemption. In Suriname, no plating industry exists, and no historic plating activities have been recorded.

**Oil drilling**

PFOS was and is still used in oil-drilling operations. Suriname has oil-drilling activities where PFOS might be used. However, more information should be collected and evaluated to generate the appropriate data. To overcome this problem, further information from the company should be gathered. Also, monitoring at the oil-drilling sites could show if PFOS was and possibly is still used. An assessment with monitoring (TIER III) was not in the scope of the inventory and analysis of PFOS and precursor chemicals are currently not available in Suriname.

#### 2.3.6.4. Potential impacts

The use of PFOS and other highly fluorinated substances in firefighting foam and associated release are particularly problematic as it involves direct release into the environment.[85] PFOS and other PFAS are also released from landfills and dumpsites from PFOS/PFAS-containing waste.[86,87] Also, the use of sulfluramid as pesticide (Mirex-S) resulted in the release of approx. 75 kg PFOS precursor in Suriname in recent years and has now stopped. Highly fluorinated substances can cause very long-term problems in the environment

[85] Hu XC, Andrews DQ, et al. (2016) Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants. Environ Sci Technol Lett. 3(10):344-350.

[86] Weber R, Watson A, Forter M, Oliaei F (2011) Persistent Organic Pollutants and Landfills - A Review of Past Experiences and Future Challenges. Waste Management & Research 29 (1), 107-121.

[87] Lang JR, Allred BM, Field JA, Levis JW, Barlaz MA (2017) National Estimate of Per- and Polyfluoroalkyl Substance (PFAS) Release to U.S. Municipal Landfill Leachate. Environ Sci Technol. 51(4):2197-2205.

by contaminating groundwater, drinking water and soil.[85,88] The assessment of firefighting foam used in Suriname indicate that drinking water reservoirs might be impacted (see below chapter 2.3.8.4).

## *2.3.7. Assessment of releases of unintentionally produced chemicals (Annex C)*

### 2.3.7.1. General

Polychlorinated dibenz*o*-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), together with polychlorinated biphenyls (PCBs), HCB, pentachlorobenzene (PeCB), hexachlorobutadiene (HCBD) and polychlorinated naphthalenes (PCNs) are listed in Annex C of the SC as unintentionally-produced POPs (UPOPs) often also called “by-products”. PCBs, PCNs, HCB and PeCB have also been industrially produced and used in several applications. PCDD/Fs were not produced commercially,[89,] and they have no known use. PCDD/Fs and the other UPOP formation and/or releases arise mainly from four types of sources.

Three releases are process-related:

- **Chemical production processes:** the production of chlorine, chlorinated phenols and other chlorinated aromatic compounds; the production of chlorinated solvents and the oxychlorination of mixed feeds to make certain chlorinated solvents; the use of chlorine in industrial process like the production of magnesium or titanium oxide using elemental chlorine, pulp, and paper using elemental chlorine for chemical bleaching;
- **Thermal and combustion processes:** destruction of POPs and other organochlorine-containing waste, general incineration of wastes, the thermal processing of metals—namely, metal production from metal scraps;
- **Biogenic processes or photolytic processes:** can form PCDD/Fs from precursors mostly of anthropogenic origin such as PCP and other chlorinated phenols. Also, the degradation of certain organochlorines can form UPOPs; e.g., pentachloronitrobenzene (PCNB) (Quintozene) partly degrades to PeCB and is considered one of the largest sources of PeCB.[90]

Meanwhile, the fourth, and probably by far the largest source, is related to historic formation and releases of PCDD/Fs and other UPOPs[91]:

- **Reservoir sources, such as historic landfills and dumps of PCDD/Fs and other UPOPs-containing wastes**: stem largely from chlorine and organochlorine production. Historic inventories reveal that they have exceeded by far the documented releases from contemporary sources**[47]**. This can, for example, be illustrated by the historic PCDD/F inventory compiled for Japan. PCDD/F contamination from pesticide-use between 1950 and 1998 in Japan alone has been estimated at 460 kg TEQ largely from pesticide use[91] similar to the finding in Suriname. By comparison, contemporary global releases of PCDD/Fs from 196 countries have been estimated at approximately 100 kg TEQ/year[92]. Similarly, this estimated contemporary inventories-releases can be compared to other historic PCDD/F releases, such as the release of 33 to 854 kg TEQ from a single pesticide factory in

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88 Brambilla G, D’Hollander W, Oliaei F, Stahl T, Weber R (2015) Pathways and factors for food safety and food security at PFOS contaminated sites within a problem based learning approach. Chemosphere 129, 192-202.

89 Except for analytical standards.

90 Stockholm Convention document from the 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/21).

91 For an overview see Weber R, Gaus C, Tysklind M et al (2008) Dioxin- and POP-contaminated sites—contemporary and future relevance and challenges. Env Sci Pollut Res 15, 363-393. The historic PCDD/F inventory of Japan does not yet include the large PCDD/F deposits from organochlorine and chlorine production.

92 Wang B, Fiedler H, Huang J, Deng S, Wang Y, Yu G (2016) A primary estimate of global PCDD/F release based on the quantity and quality of national economic and social activities. Chemosphere. 151, 303-309.

Hamburg[93] or the estimated dioxin release of more than 366 kg TEQ from spraying of defoliants in the Vietnam War[94]

- **Soils and sediments:** have accumulated PCDD/Fs and other (U)POPs over the last 100 years of releases from application of organochlorines containing UPOPs or releases from incinerators, metal industries or open burning. The PCDD/F-contaminated sites, soils, and sediments from the past release are still relevant for food contamination (e.g. fishes, chicken/egg, grazing cattle and milk and dairy products).

#### 2.3.7.2. Stockholm Convention obligation with respect to Dioxins/UPOPs (Article 5)

The framework for the activities and the action plan for PCDD/Fs and other Annex C chemicals is given by the obligations of Article 5 of the Convention.

**Article 5** of the SC, covering the measures to reduce and eliminate releases from unintentional production, states that each Party shall, at a minimum, take the following measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimisation, and, where feasible, ultimate elimination (paraphrased and summarised):

**Article 5 (a):** Develop an action plan with the elements 5a (i-v) to facilitate its implementation (subparagraph (b) to (e)

**Article 5 (a) (i):** Evaluate current and projected releases, including the development and maintenance of source inventories and release estimates, taking into consideration the source categories identified in Annex C.

**Article 5 (a) (ii):** Evaluate the efficacy of laws and policies to manage releases.

**Article 5 (a) (iii):** Identify strategies to meet dioxin reduction obligations, considering the evaluations in (i) and (ii).

**Article 5 (a) (iv):** Take steps to promote education and training and raise awareness of the strategies.

**Article 5 (a) (v):** Review, evaluate, and report on strategies every five years in meeting release-reduction obligations.

**Article 5 (a) (vi)**: Develop a schedule for implementation of the action plan, including the strategies and the measures identified in them.

**Article 5 (b):** Promote the application of available, feasible, and practical measures that can readily achieve a realistic and meaningful level of release reduction or source elimination.

**Article 5 (c):** Promote the development and use of substitute or modified materials, products, and processes to prevent the release of Annex C chemicals.

**Article 5 (d):** Promote and, as soon as practicable, require BAT/BEP for new installations (sources) listed in Annex C Part II.

**Article 5 (e):** Promote BAT/BEP for existing installations (sources) listed in Annex C Parts II and III and for new sources listed in Annex C Part II.

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[93] Götz R, Sokollek V, Weber R (2013) The Dioxin/POPs legacy of pesticide production in Hamburg: Part 2: Waste deposits and remediation of Georgswerder landfill. Env Sci Pollut Res. 20, 1925-1936.

[94] Stellmann MJ, Stellmann SD, Christian R, Weber T, Tomasallo C (2003) The extent and patterns of usage of Agent Orange and other herbicides in Vietnam. Nature 422, 681-687.

### 2.3.7.3. Inventory of PCDD/Fs and other unintentionally produced POPs

The emission factors of the "Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs under Article 5 of the Stockholm Convention on Persistent Organic Pollutants", 2013; http://toolkit.pops.int/)[95] was used in updating the inventory for PCDD/Fs. During incineration and other thermal processes, PCDD/Fs and the other listed unintentional-POPs (PCBs, PCNs, HCB and PeCB) are formed together. The Toolkit recommends, for practical reasons, that inventory activities be focused on PCDD/Fs, as these substances are indicative of the presence of other unintentional POPs.[95] They are considered to constitute a sufficient basis for identifying and prioritising sources of all such substances as well as for devising applicable control measures for all Annex C POPs and for evaluating their efficacy. Since the major emission sources in Suriname are thermal sources, the reduction of all UPOPs from these sources can be achieved by the inventory and reduction of PCDD/Fs. Therefore, the updated inventory of PCDD/Fs is representative for the other UPOP for most processes. The sources where specific UPOPs are formed and are not covered by the PCDD/F inventory (e.g. production of specific pigments or specific pesticides and degradation products), are specifically mentioned and addressed. In respect to the newly listed unintentional PCNs and HCBD it was assessed if sources are present in Suriname (see below).

This is the second PCDD/F inventory report of Suriname after establishing a baseline inventory for 2009, and it presents estimates of release for the inventory year 2015 where at the time of inventory development most data were available. For this purpose, the dioxin task team screened all 10 release source groups listed in the UNEP toolkit (waste incineration, metal industry, power generation, mineral production, transport, open burning, chemical and consumer goods, disposal and hot spots (including all source categories identified in Annex C of the SC)) for PCDD/F release and evaluated their relevance for the country.

Based on the assessment of data from the reference year 2015, the estimate of total annual PCDD/F release is approximately 77.7 g TEQ for 2015. The summary Table 14 gives an overview of the releases from the source categories and release vectors. The major emissions of PCDD/Fs into the environment of Suriname (for 2015) come from combustion processes (46.5 g TEQ; 59%) with major contribution from open burning (42.1 g TEQ; 54% of total release). The major source is waste burning on landfills/dumps (38.3 g TEQ/year) and further release from private waste burning (3.47 g TEQ/year).)

The second largest source was the use of 2,4-D and derivatives (55,800 tonnes formulation including 40,182 tonnes active ingredients) with an estimated PCDD/F release of 29.0 g TEQ corresponding to 37.2% of total emission for 2015.

The update assessment has attempted to calculate the release of PCDD/F from the chlorine production. A careful estimate has shown that the sludge formed in this process could be highly contaminated with PCDD/F. Due to the relatively low total generation of residues, this process is estimated to result in a release of 0.02 g TEQ/year. It needs to be stressed that the residues have high PCDD/F concentration and need to be managed appropriately.

Furthermore, the PCDD/F inventory from former air-spray application of PCP on rice fields (confirmed for air spray operations from 1964 to the 1970s) has been estimated at 1,431 g I-TEQ for the rice plantation area of Wageningen. The total release from PCP-use for all former rice fields in Suriname between 1964 and early 1970s is estimated to be approximately 5,565 g I-TEQ.[96] While this is not a current PCDD/F release, this historic legacy can be due to the high persistence of PCDD/F that may still have current impact on biota and subsequent accumulation in the food chain thus posing a current threat to human health. Initial sampling of cow milk from a potentially impacted area has been taken but have not yet been analysed.

For comparison and time trend, the total releases of the updated baseline inventory from 2010 is compiled in Table 15. For a correct comparison, the baseline inventory was recalculated with the revised emission

[95] UNEP (2013) Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs under Article 5 of the Stockholm Convention on Persistent Organic Pollutants.

[96] This is rather an underestimation of total release from historic PCP-use in Suriname since PCP has most probably been applied already before 1964. As basis of the calculation, available data on PCDD/P content in PCP formulation from the 1960s and the early 1970s have been used for this estimate from Masunaga S, Takasuga T, Nakanishi (2001) J Chemosphere 44, 873-885.

factors from Toolkit version 2013 (e.g. for open waste burning). Also missing sources in the 2010 inventory have been calculated and included.

The total release in the baseline inventory 2010 was 80.4 g TEQ, comparing the baseline inventory from 2010 (80.4 g TEQ; see Table 15) with the inventory from 2015 (78 g TEQ; see; Table 14) a slight overall decrease of 2.4 g TEQ (3 %) was observed. This was mainly caused by a decrease in 2,4-D use and related reduced PCDD/F release (29 g TEQ compared to 35.9 g TEQ). While a slight increase in release from open waste burning (42.2 g TEQ compared to 41.25 g TEQ) was observed due to the increase of waste generation owing to increased consumption. This overcompensated the reduction of average open burning on landfills. An increase in release from hospital waste incineration (3.2 g compared to 0.9 g TEQ) was also observed due to an increase in combusted waste.

*Table 14. Releases of PCDD/Fs from the main source groups to the release vectors in 2015*

| Group | Source Groups | Annual Releases (g TEQ/a) | | | | |
|---|---|---|---|---|---|---|
| | | **Air** | **Water** | **Land** | **Product** | **Residue** |
| 1 | Waste Incineration | 3.15 | 0.000 | 0.000 | 0.000 | 0.021 |
| 2 | Ferrous and Non-Ferrous Metal Production | 0.17 | 0.000 | 0.000 | 0.000 | 0.025 |
| 3 | Heat and Power Generation | 0.57 | 0.000 | 0.000 | 0.000 | 0.005 |
| 4 | Production of Mineral Products | 0.001 | 0.000 | 0.000 | 0.025 | 0.084 |
| 5 | Transportation | 0.025 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6 | Open Burning Processes | 40.72 | 0.000 | 1.400 | 0.000 | 0.000 |
| 7 | Production/use of Chemicals & Consumer Goods | 0.000 | 0.000 | 29.0 | 0.000 | 0.020 |
| 8 | Miscellaneous | 0.057 | 0.000 | 0.000 | 0.000 | 0.003 |
| 9 | Disposal | 0.000 | 0.009 | 0.000 | 0.000 | 2.470 |
| 10 | Identification of Potential Hot-Spots | - | - | 5565[96] | 0.000 | 0.000 |
| **1-10** | **Total** | **44.67** | **0.009** | **30.40** | **0.025** | **2.63** |
| **Grand Total** | | **77.7** | | | | |

*Table 15. Releases of PCDD/Fs to the release vectors of the updated 2010 baseline inventory*

| Cat. | Source Categories | Annual Releases (g TEQ/a) 2010 Total dioxins and furans emission to: | | | | |
|---|---|---|---|---|---|---|
| | | **Air** | **Water** | **Land** | **Products** | **Residue** |
| 1 | Waste Incineration | 0.914 | 0.000 | 0.000 | 0.000 | 0.0 |
| 2 | Ferrous and Non-Ferrous Metal Production | 0.017 | 0.000 | 0.000 | 0.000 | 0.0 |
| 3 | Power Generation and Heating | 0.006 | 0.000 | 0.000 | 0.000 | 0.0 |
| 4 | Production of Mineral Products | 0.011 | 0.000 | 0.000 | 0.000 | 0.0 |
| 5 | Transportation | 0.170 | 0.000 | 0.000 | 0.000 | 0.0 |
| 6 | Uncontrolled Combustion Processes | 39.28 | 0.000 | 1.97 | 0.000 | 0.0 |
| 7 | Production/use of Chemicals & Consumer Goods | 0.000 | 0.000 | 35.9 | 0.005 | 0.0 |
| 8 | Miscellaneous | 0.057 | 0.000 | 0.000 | 0.000 | 0.1 |

| Cat. | Source Categories | Annual Releases (g TEQ/a) 2010 Total dioxins and furans emission to: | | | | |
|---|---|---|---|---|---|---|
| | | Air | Water | Land | Products | Residue |
| 9 | Disposal/Landfilling | 0.000 | 0.000 | 0.000 | 0.000 | 2.0 |
| 10 | Identification of Potential Hot-Spots | - | - | 5565 | 0 | 0 |
| **1-9** | **Total** | **40.5** | **0.0** | **37.9** | **0.0** | **2.1** |
| **Grand Total** | | **80.4** | | | | |

The newly listed unintentional PCNs (05/2015) are formed - similarly to unintentional PCBs, HCB and PeCB - as unintentional POPs together with PCDD/Fs in thermal processes.[97,98] Specific emission factors for PCNs for the thermal sources have not been established yet and the WHO expert group has not assigned Toxic Equivalency Factors for PCNs but acknowledged that they possess dioxin-like activity.[99] PCNs are unintentionally formed in thermal processes together with other unintentional POPs such as PCDD/Fs. The UPOPs Toolkit and the PCN inventory guidance stress that UPOPs releases of most sources can be minimised or eliminated by the same measures that are used to address PCDD/F releases.[95] Therefore the detailed updated inventory of PCDD/Fs for Suriname allows the identification of priority sources of all UPOPs and the setting of measures and development of action plans to minimise releases of all unintentional POPs. For unintentional PCNs, the inventory guidance mentions few processes where PCDD/F releases are not indicative for PCNs but where specific assessment for PCNs and some other UPOPs are needed. These include unintentional PCNs in the production of chlorine, presence in industrial PCB mixtures and in the production of chlorinated solvents and chlorinated paraffins.[97] Suriname has a production of elemental chlorine; therefore, during this process unintentional PCNs are likely formed at considerably higher levels than PCDD/Fs. For a detailed inventory, the residues from chlorine production need to be measured for UPOPs. It must be stressed that while no chlorinated paraffins are produced in Suriname, they are likely imported in products like polyvinyl chloride (PVC), rubber, paints and industrial oils. By those imports also unintentional PCNs are likely imported to Suriname. While SCCPs have been listed in the Convention, there is currently no guidance established to quantify the presence and imports of SCCPs in products. In addition, PCNs are present in PCB oils at mg/kg levels. PCNs are present to some extent in the remaining PCB oils. The PCB inventory and management cover the management of these PCNs.

HCBD is unintentionally formed in some specific organochlorine production such as organochlorine solvents (tetrachloroethene, tetrachloromethane, trichloroethane) and primary PVC production and some other organochlorine processes[100]. These processes were and are not present in Suriname and therefore no major unintentional formation/release of HCBD is present in Suriname. HCBD can also be formed in thermal processes including refining processes in the aluminium and magnesium industry, secondary copper industry, incineration of high chlorine-containing waste and chorine production.[100] From these processes Suriname only has elemental chlorine production and formerly had aluminium production. Therefore, waste from the chlorine production is considered to contain some HCBD. The total concentration of HCBD in residues from the chlorine production is considered less than 10 kg. Since the aluminium

[97] Secretariat of the Stockholm Convention (2017) Draft guidance on preparing inventories of polychlorinated naphthalenes (PCNs). UNEP/POPS/COP.8/INF/19.

[98] Weber R, Iino F, Imagawa T, Takeuchi M, Sakurai T, Sadakata M (2001) Formation of PCDF, PCDD, PCB, and PCN in de novo synthesis from PAH: mechanistic aspects and correlation to fluidized bed incinerators. Chemosphere. 44(6), 1429-1438.

[99] Van den Berg et al. (2013) Review Polybrominated Dibenzo-p-Dioxins, Dibenzofurans, and Biphenyls: Inclusion in the Toxicity Equivalency Factor Concept for Dioxin-Like Compounds. toxicological sciences 133(2), 197–208 2013.

[100] Secretariat of the Stockholm Convention (2017) Draft guidance on preparing inventories of hexachlorobutadiene (HCBD). UNEP/POPS/COP.8/INF/18.

production has closed, there is no current release. However, there might be HCBD-containing residue at the landfills.

### 2.3.8. *Information on the state of knowledge on contaminated sites and wastes, identification, likely numbers, remediation measures, and data on releases from sites*

This section compiles information on contaminated sites for individual POPs. The inventory of stocks and wastes for the individual POPs are included in the individual POPs section above.

#### 2.3.8.1. POPs pesticide-contaminated sites

The pesticide stockpiles have been removed from the related storage sites (see Section 2.3.1 and Appendix) and therefore the highest exposure risk of the waste pesticides formerly stored at these sites has been stopped.

Information on contaminated soil and groundwater present at storage sites (old and currently used) is not available. Based on the POPs-site inventory from the first NIP (see Appendix), it is assumed that at a certain number of the storage sites listed in Appendix, the soil, and the groundwater are possibly contaminated. Soil samples were taken from the storage facility at Marienburg and Peperpot in Commewijne. Also, soil samples were taken within the FAO/GEF project in Nickerie at one of the airfields (alibux). No samples were taken from the Banana Company because it is a private company. Analysis is done within the FAO/GEF project in collaboration with the University of the West Indies. No water samples were taken (yet) because it needs to be assessed within one week after collection or certain cooling requirements are needed.

The situation at these sites concerning the environmental quality of the possible soil and groundwater contamination can be classified in:

- Contaminated sites from pesticide application:
    - 35,000 hectares of rice fields were sprayed in the 1960s/70s and earlier with PCP containing PCDD/Fs. While after decades the PCP has likely degraded, it is known from studies in Japan and Australia that these areas are still contaminated with PCDD/Fs.[101,102]
    - DDT have been sprayed in many areas in the past
- Contaminated hotspots

  The locations where spills and leakage took place and pure pesticides have entered the soil - and most likely the groundwater at places where the groundwater table is shallow (within 2 meters below the surface level. The levels of organic compounds are high, and the contaminated soil in the hotspots must be treated as POPs. Most of these hotspots are located at:
    - On and off-loading platforms
    - Mixing / preparation basins
    - Filling station at airstrips
    - Not well-maintained storage buildings
- The contaminated soil and groundwater around the hotspots

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[101] Camenzuli L, Scheringer M, Gaus C, et al. (2015) Historical emissions of octachlorodibenzodioxin in a watershed in Queensland, Australia: estimation from field data and an environmental fate model. Science of the Total Environment, 502, 680-687.

[102] Weber R, Masunaga S (2005) PCDD/F contamination from historical pesticide use and production – a case study using data from Japan and Germany. Proceedings of the 8th HCH and Pesticide Conference, 26-28 May 2005, Sofia, Bulgaria.

- If the soil is contaminated at levels below the 50 mg per kg of dry matter, the soil should be treated as contaminated soil. To establish the degree and extent of contamination in the vertical and horizontal directions, a soil survey is needed. The processes responsible for the dispersion in the horizontal direction of the contaminants are surface runoff of rainwater, wind, and groundworks. Percolation of rainwater accelerates the spreading of the contaminants in the subsoil and groundwater.
- If the groundwater is contaminated, it should be treated as such. To establish the degree and extent in the vertical and horizontal directions, a groundwater survey is needed. The processes responsible for the dispersion in the horizontal direction of the contaminants are groundwater streaming, drainage, and pumping of groundwater. The natural infiltration of rain and groundwater, and the pumping of groundwater are responsible for the migration of the contaminants into deeper aquifers.

Soil and groundwater surveys and assessments of the sites need to be conducted to know the usage of the site and its surrounding, as well as the potential impact of the contaminated sites. The possible potential impacts are:

- Direct risks related to the hotspot, the contaminated buildings, and the contaminated groundwater
- Potential risks related to the contaminated soil and groundwater
- Latent risks related to the contaminated soil and groundwater

With the second part of the FAO pesticide project, Dr. Gaius Eudoxie from UWI has taken samples from Marienburg, Peperpot and an airstrip in Nickerie. The samples are being analysed.

#### 2.3.8.2. PCB-contaminated sites

A range of potential PCB-contaminated sites was identified during the inventory. PCB-contaminated sites are related to PCB-storage sites and where PCB transformers have been operating. There was a first screening of the storage site of N.V. Before 2008 EBS transformer oil had leaked and showed PCB levels below 0.5 mg/kg. The storage site was re-developed according to safety and environmental standards.

Other sites like areas where transformers were operated for long time, sites where transformers were maintained, landfills where wastes from companies possessing PCB-containing equipment have been landfilled or sites where scrap metal was sorted and recycled, have not been assessed. Such assessments should be performed within the NIP implementation. Some of the sites are close to rivers. It is known that PCB-contaminated sites can adversely impact adjacent rivers and their fish resources with exposure risk to humans[103] Therefore, fish in the rivers, close to potential PCB-contaminated sites could be screened as indicators.

#### 2.3.8.3. POP-PBDE, HBB and HBCD and contaminated sites and hotspots

Only a small part of WEEE is collected for recycling. The main part of WEEE generated is collected and disposed of with the general domestic waste. Some households dump their WEEE along roads or deserted plots. Currently, there is no formal or institutional recycling of WEEE in Suriname. Recycling is mostly done by the informal sector. WEEE is not separated from domestic waste. All the wastes are taken to the dumpsite (open dumping) where waste pickers remove any waste with economic value and sell it to interested retailers. These retailers visit the dumpsite frequently to collect the recyclables. There is some smouldering of e-waste and cables which result in contaminated soils at these areas.

Other potentially POP-BFR-containing materials like obsolete furniture, construction material and mattresses are all dumped at the open dump or along deserted roads (where no or few people live). The country has nine official dumping sites (one in each district) and many other illegal waste dumping sites

[103] Zennegg M, Schmid P, Tremp J (2010) PCB FISH CONTAMINATION IN SWISS RIVERS – TRACING OF POINT SOURCES. Organohalogen Compounds 72, 362-365. http://www.unido.org/index.php?id=1001169

scattered across the country. None of the official dumping sites comply with international standards or are equipped with measures to avoid emissions of hazardous substances to the environment. Since recycling plants do not use BAT/BEP there is a risk of soil contamination. All these facilities transport their waste (unwanted materials) to the dumpsites.

Dumping results in emissions of hazardous substances to the environment, mainly air, soil and underground water sources or nearest surface water sources. All the dumping sites and sites where these polymer fractions are disposed have frequent open burning which result in releases of POPs present in the waste and in the formation of UPOPs including PCDD/Fs and brominated PBDD/Fs.[104] Over time these sites and the surrounding soils can become contaminated with these POPs.

#### 2.3.8.4. PFOS-contaminated sites and hotspots

PFOS is highly persistent and no degradation is known in soil and groundwater. Therefore, the PFOS released in the last 50 years to soil and ground- and surface water has likely accumulated in these environmental matrices or has been further transported in the environment. Therefore, sites where PFOS has been released can be considered potentially contaminated sites. There is currently no analytical capacity in Suriname to assess the related contamination.

**A) PFOS-contaminated sites from firefighting foam storage, training and use in fires**

In Suriname, several potential PFOS contamination sites were identified. All training/drill areas and flushing of firefighting vehicles pipe sites (at caserns) are possibly contaminated, since the training/drill and vehicle-pipe rinsing are performed on site with associated releases. STAATSOLIE N.V. has a very well-established waste management program, but for trainings/drills a specific waste management approach has not yet been established and therefore training/drills are performed on site without waste management for the foam used.

At the International Airport, Johan Adolf Pengel Luchthaven, where PFOS-containing firefighting foam has been used is above a major drinking water reservoir of Suriname. There is an urgent need to assess if and to what extent this reservoir is contaminated and if drinking water of Paramaribo is affected. Furthermore, the history of firefighting training sites and related impacted areas need further assessment.

A potential PFOS-contaminated site requiring further investigation is the large airplane crash in Suriname (1987), where a large amount of foam was used. No data are available and the spot has not been visited yet for an assessment. There were also several small plane crashes after 1987 but data are lacking regarding the use and amount of foam used.

**B) PFOS-contaminated sites from use of sulfluramid**

As many of the inhabitants of Suriname use ant powder including some that contain sulfluramid, the related homes (gardens), and all grocery shops and factories where the powder/baits were used are potentially contaminated sites or at least have hot spots where the baits or powder have been distributed. About 75 kg of PFOS precursors have been sold/released. These hot spots, close to population, need attention.

**C) Potential PFOS-contaminated sites from other industrial activities**

PFOS has been used in mining activities. Suriname has/had large bauxite mining activities and landfills from bauxite mining and processing. These sites and other mining sites might potentially be contaminated with PFOS and related substances.

[104] Gullett BK, Wyrzykowska B, Grandesso E, Touati A, Tabor DG, Ochoa GS (2010) PCDD/F, PBDD/F, and PBDE emissions from open burning of a residential waste dump Environ Sci Technol. 44(1):394-399.

**D) PFOS-contaminated sites from disposal of PFOS and related substances in consumables**

A wide range of consumer products including synthetic carpets, furniture, textiles and surface-treated paper contained PFOS and related substances from the last 50 years. These products together with PFOS and related substances have been and are deposited and disposed of since the introduction of these products in Suriname. As a result, Ornamibo Open Dumpsite (OSL) and other dumpsites are a reservoir of PFOS and related substances and other PFAS from products/articles dumped the last 40 years. Consequently, OSL (and other dumpsites) contain PFOS and related substances, which are released into leachate. Leachates from OSL are partly released into the Para River with associated impact on sediment, water and fishes. Due to the lack of well-equipped laboratories and well-trained scientists, no detailed assessment can currently be conducted.

It should be noted that the waste management framework in Suriname is not appropriate and currently most waste fractions are not separated but are continuously dumped.

#### 2.3.8.5. PCDD/F and other UPOPs contaminated sites and hotspots

As mentioned previously, today the largest amounts of PCDD/Fs present are from historic releases of the chlorine and organochlorine industry, from the application of organochlorine pesticides, and present at contaminated sites - including landfills and deposits, but also in soils and sediments[105,61] Also release from thermal processes like incinerators and metal industries have resulted in contaminated sites.

An initial screening for possible PCDD/Fs and UPOPs-contaminated sites has been conducted, and a range of possibly PCDD/F-contaminated sites has been discovered.

**A) Chlorine production site**

In Suriname, a detergent-bleach factory started operation in 1982. The company produces chlorine and bleaching powder. During the inventory process within this company, it has been noticed that the company possibly used technologies involving graphite electrodes. Accurate data-gathering was very difficult, and information of this company was based on verbal communication. No official information about the use of electrodes and closing of cells were available; the same was the case with possible deposits and storage or dumping of generated waste.

**B) Formulation sites, storage sites and application sites of PCDD/F-containing pesticides**

Suriname has a long history of agriculture and wood treatment where PCP and other dioxin-containing pesticides have been used. PCP has been used from the 1950s to the 1970s in rice fields for snail control. It was also used in swamps against snails. From 1964 through the 1970s, the PCP has been applied to a large extent via aircraft spray operations. The PCDD/F inventory from former aircraft spray-application of PCP to rice fields (confirmed for air spray operations from 1964 to the 1970s) has been estimated to be 5,565 g I-TEQ.[106 62]

In a first assessment at Mariënburg, three potential hotspots were found:

1. The mixing and loading area;
2. The area near the air strip where the air planes and tanks were emptied and cleaned; and
3. The area where, for decades, pesticide residues, including PCP, have been burned in the open.

Also, other potentially PCDD/F-containing pesticides have been used in Suriname and 2,4-D is still being used.

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[105] Weber R, Gaus C, Tysklind M et al (2008) Dioxin- and POP-contaminated sites—contemporary and future relevance and challenges. Env Sci Pollut Res 15, 363-393.

[106] This is rather an underestimation of total release from historic PCP use in Suriname since PCP has most probably been applied already before 1964. As basis of the calculation available data on PCDD/F content in PCP formulation from the 1960s and the early 1970s have been use for this estimate from Masunaga S, Takasuga T, Nakanishi (2001) J Chemosphere 44, 873-885.

**C) Timber manufacturing and treatment sites**

Sodium PCP and PCP were used to treat wood in the 1960s and up to the 1980s, sometimes in combination with Lindane. Furthermore, PCP was used until the beginning of the 80s to impregnate wooden window frames and as well as a component of anti-mildew paint. PCP and 2, 4, 5-T were used at interior locations in Suriname at several wood treatment sites, and possibly other applications, until the 80s. The various wood treatment sites are considered contaminated with PCDD/Fs and PCP. These sites are also likely contaminated with Wolman salt used for wood treatment.

**D) PCB-contaminated sites**

The potentially PCB-contaminated sites can also be considered as potentially PCDF-contaminated. An assessment of sites should consider this contaminant especially if a transformer/capacitor fire occurred.

**E) Waste incinerators**

In Suriname, only a few small hospital waste incinerators are operated. The technology is non-BAT and high levels of PCDD/F can be released. The soils in the direct vicinity of the incinerator might be contaminated to some extent.

**F) Metal industries**

The sites where metal smelters are or were operated can be impacted and contaminated by the long-term releases of PCDD/F, other UPOPs and heavy metals. Residues from the former aluminium smelter were disposed in a landfill without liner and might contain PCDD/F and other UPOPs including HCBD.

Sites where cables and e-waste are smouldered for recovery of copper and metals by the informal sector can be considered hot spots, contaminated by PCDD/F and heavy metals.

**G) Dredging of sediments in the Suriname River**

Experimental sediment dredging took place a few years ago. The aquatic pathway in the Suriname River has been deepened and shipment was maintained. There is no data available about what was done with the sediment dredged. It is suggested that the sediment was deposited somewhere else near the estuary of the river. The levels in the sediments might have been low since no specific industrial activities have released PCDD/F into the river. A potential contamination source of the sediments source might be PCP use. Research activity on sediment disposal is proposed in the NIP. This research should establish whether the dredging sludge depots are possible sources of contamination.

**H) Dumps and disposal areas of PCDD/F-containing residues**

Where PCDD/F- and other UPOPs-containing products or residues have been disposed of, there is a probability that these contaminants will be released into the environment. PCDD/Fs are relatively immobile in dumps or landfills as long as there are no organic co-deposits facilitating leaching or seepage water capable of mobilising the contamination. The more water-soluble UPOPs (HCBD, PeCB) can also be directly released through leaching, in relevant amounts[107] and even impact drinking water.[108] Of possible relevance is also the remobilisation of PCDD/Fs and other UPOPs-containing deposits if such landfills or dumps are excavated due to remediation measures or for mining purposes.[109]

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[107] Weber R, Watson A, Forter M, Oliaei F (2011) Persistent Organic Pollutants and Landfills - A Review of Past Experiences and Future Challenges. Waste Management & Research 29 (1) 107-121.

[108] Forter M (2016) Hexachlorobutadiene in the drinking water of the City of. Basel (Switzerland), the Rhine and the chemical landfill „Feldreben" of BASF, Novartis and Syngenta. Conference proceeding; 13 IHPA (International HCH & Pesticides Association) Forum, November 03-06, 2015, Zaragoza, Spain.

[109] Torres JPM, Leite C, Krauss T, Weber R (2013) Landfill mining from a deposit of the chlorine/ organochlorine industry as source of dioxin contamination of animal feed and assessment of the responsible processes. Env Sci Pollut Res. 20, 1958-1965.

In Suriname, some historic and current industrial processes might have generated PCDD/F and other UPOPs-contaminated residues which have been deposited. These processes include former production of aluminium where residues have been disposed to an unlined landfill and current production of iron from scrap metal. Also, ashes are generated from hospital waste incineration and are dumped near the incinerators or at dumpsites.

Furthermore, landfills and dumpsites in Suriname could be a reservoir of PCDD/F and other UPOPs-containing products or residues. Long term open burning has released PCDD/F and other UPOPs over time with potential impact on the soils in the surrounding.

**I) Kaolin sites**

At several locations in the world, PCDD-contaminated kaolin/ball clay has been discovered.[110] The country has large kaolin resources, and the kaolin will be processed to meta kaolin, with which high quality building materials will be fabricated as end-products. Clay is partly consumed by people (Pemba). A first measurement of Pemba from Suriname did not reveal relevant levels of PCDD.[111]

### *2.3.9. Future production, use and releases of POPs requirements for exemptions*

In the assessment of individual POPs with exemption of use (PFOS, Lindane, PCP, DDT, PBDE recycling) no need of any exemption has been found. Instead, most of these POPs (PFOS, lindane, PCP, DDT) have already been banned.

Also, there is currently no need for an exemption of HBCD in EPS/XPS and alternatives exist.

The need of exemption and use will need to be assessed for short chain chlorinated paraffins listed 2017 (see action plan).

Currently, lindane is still available for second-line treatment in shops but import has stopped.

### *2.3.10. Existing programmes for monitoring releases and environmental and human health impacts, including findings*

The POP contamination level of humans can be determined by assessing levels in human milk or blood. The laboratory of BOG developed and conducted a human milk project for monitoring POPs in cooperation with the WHO reference laboratory in Freiburg/Germany. Almost 40 donors from Paramaribo/Wanica region have been sampled. A pooled sample was sent to the WHO laboratory and it was analysed for POPs pesticides (see Table 16), PCDD/F and PCBs. With the exemption of DDT group (1,392 ng/g fat), other POPs pesticide levels were low (Table 16). The PCDD/F levels in pooled human milk sample was 3.42 ng TEQ/g fat which in comparison to human milk levels in other countries is at the lower end; however, the level is still above the Tolerable Daily Intake (TDI). Due to the benefits of human milk the WHO recommends exclusive breastfeeding for the first 6 months. The PCDD/F congener pattern is dominated by congeners from PCP with high concentration of Octachlorodibenzodioxin (OCDD) and Heptachlorodibenzo-p-dioxin (HpCDD) and particular elevated 1,2,3,6,7,8-HxCDD (Hexachlorodibenzo-p-dioxin) compared to the two other 2,3,7,8-substituted HxCDDs. Also, the dioxin-like PCB concentration was low (1.84 ng TEQ/g fat), indicating that the PCB exposure of the average population in Paramaribo and Wanica region is low. The remaining individual samples still need to be analysed. Due to lack of support in funding for training, the purchase of standards, reagents and minor equipment, is currently pending.

[110] Horii Y et al. (2011) Distribution, characteristics, and worldwide inventory of dioxins in kaolin ball clays. Environ Sci Technol. 45(17), 7517-7524.

[111] Reeuwijk et al. (2013). Dioxins (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-furans) in traditional clay products used during pregnancy. Chemosphere. 90(5), 1678-1685.

A monitoring programme for soil, water, and air contamination - resulting from the use on POPs - is weak due to the absence of legislation, the lack of technical capacity such as laboratory facilities and equipment, as well as human resources.

Cow milk samples have been collected from Nickerie and Paramaribo/Wanica and sent for analysis to a lab in Europe by the laboratory of BOG. No analysis has been done so far, despite several attempts. Currently monitoring of PCDD/F and PCB in chicken eggs is conducted in cooperation with RIKILT Institute in the Netherlands.

In a study of clay consumed by (pregnant) women in the Netherlands, which included some clays from Suriname, was measured for POPs.[112] The levels in the samples from Suriname were low. Currently more clay samples (Pemba) have been collected for a more systematic assessment to determine if such clay is a source of exposure.

*Table 16. Levels in POPs pesticides in pooled human milk samples from Suriname (2013)*

| | | Concentration ng/g lipid weight |
|---|---|---|
| **Aldrin** | | nd |
| **Chlordane group** | 1) | 2.6 |
| alpha-chlordane | | nd |
| gamma-chlordane | | nd |
| oxy-chlordane | | 2.7 |
| **Trans-nonachlor** | | 4.1 |
| **Dieldrin** | | 1.5 |
| **DDT group** | 2) | 1392 |
| o,p'-DDD | | nd |
| p,p'-DDD | | 1.5 |
| o,p'-DDE | | nd |
| p,p'-DDE | | 1163 |
| o,p'-DDT | | 14.0 |
| p,p'-DDT | | 79.6 |
| **Endrin group** | 3) | nd |
| Endrin | | nd |
| Endrin ketone | | nd |
| **Heptachlor group** | 4) | 0.5 |
| Heptachlor | | nd |
| Heptachlor-epoxide cis | | 0.5 |
| Heptachlor-epoxide trans | | nd |
| **Hexachlorobenzene** | | 4.3 |
| **Hexachlorocyclohexane (HCH) group** | | |
| alpha-HCH | | nd |
| beta-HCH | | 17.9 |
| gamma-HCH | | nd |
| **Parlar (Toxaphene) group** | 5) | nd |
| Parlar 26 | | nd |
| Parlar 50 | | nd |
| Parlar 62 | | nd |
| **Mirex** | | 1.4 |

**Explanations:**

*nd = not detected (< 0.5 ng/g fat), 1)sum of alpha-chlordane, beta-chlordane and oxychlordane, calculated as chlordane; 2)sum of o,p'-DDT, p,p'-DDT, p,p'-DDE and p,p'-DDD, calculated as DDT; 3) sum of Endrin and Endrin ketone, calculated as Endrin; 4) sum of Heptachlor and Heptachlor-epoxid (cis/trans), calculated as Heptachlor; 5)sum of parlar 26, parlar 50 and parlar 62*

[112] Reeuwijk NM et al. (2013) Dioxins (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-furans) in traditional clay products used during pregnancy. Chemosphere 90, 1678–1685.

### *2.3.11. Current level of information, information exchange, awareness and education*

#### 2.3.11.1. General

Although there has been more awareness-raising on general environmental issues such as biodiversity and climate change in the country, specific awareness and knowledge about chemicals-management – inclusive of POPs - should be improved within the Government as well as the general public.

The local companies, (formal and informal), mainly small and medium sized; do not have proper information on POPs due to a lack of awareness. These companies' financial limitations, poor legislative framework, poor environmental management, and weak Government control result in inadequate chemical management. In contrast, large multi-national companies usually have adequate funding to keep up with the international standards. In this regard, Government institutions are well behind these companies and depend on the information that they provide.

#### 2.3.11.2. Information and awareness

The availability of information on chemicals in general - including the POPs and their impacts on human beings and the environment - is limited to those that deal with them daily, mainly persons in several Government agencies, and the private sectors. General public or nation-wide information dissemination and awareness have not been conducted structurally or on a regular basis.

**A) POPs pesticides**

In general, awareness on the use of pesticides is gradually increasing within the group of stakeholders that participate in the newly set up empty container and the IPM program. LVV, in cooperation with NGOs, and other organisations are constantly working on raising awareness, but due to the limited funds available, not all aspects are shared and not all farmers are reached on a regular basis. The development of training modules for persons making use of the pesticides is also required, and this can be done through the collaboration of Government agencies and the private sector. Furthermore, the ministry is working weekly with schools (primary and secondary schools in information sessions of responsible pesticide use). At the moment LVV is working on raising awareness of the triple rinsing and recycling of empty pesticide containers through a video on Youtube (https://www.youtube.com/watch?v=Ly4ykY9x9QI) and through the network of the importers. The ministry is also working with stakeholders to find a sustainable solution for the management of these empty pesticide containers.

During the pesticide-awareness week, a crew from the ministry also hit the streets of Paramaribo, to meet with the people on the street and talk about the dangers of pesticide; how to use and protect themselves and the available alternatives.

Awareness-raising is also done in the second grade of the secondary school starting July 2017 as a pilot, to make children aware of the dangers of pesticides and how they can protect themselves and their families. LVV is doing awareness sessions on secondary schools, colleges and ADEKUS on responsible pesticide use.

The ministry is also preparing to set up farmer field schools again in the different districts for 5 different crops (long yard beans, bitter gourd, okra, eggplant and sweet potato). Here farmers will be educated in Integrated Crop Management (ICM), Integrated Pest Management (IPM) and Good Agricultural Practices (GAP) principles

Financing is the main challenge for up-scaling awareness initiatives.

**B) Other POPs**

An awareness-raising film “POP's een Gevaar voor Mens & Milieu” on different POPs groups has been developed and has been promoted. More comprehensive education on POPs is needed. This would best be embedded in a general education and awareness-raising on chemicals and exposure using state of art information materials available[113] and developing country-specific materials.

### *2.3.12. Mechanism to report under Article 15 on measures taken to implement the provisions of the Convention and for information-exchange with other Parties to the Convention*

Like the development of the NIP, article 15 reporting is an obligation for Parties. The periodicity of the national reporting for the SC is every four years in accordance with a format as established by the COP at its first meeting (decision SC-1/22). The 4th and next reporting cycle is in August 2018. Based on the information compiled for the NIP, Suriname plans to submit the report for Article 15 reporting.

Information-exchange on POPs-related issues with other Parties to the Convention was weak in the past. Contacts have been established especially within the regional POPs project. Suriname has developed close links with other countries in the Caribbean within the regional POPs project and information-exchange is facilitated by regional workshops. Additionally, contacts have been established to the regional SC Centre in Brazil. Furthermore, Suriname participates regularly at the COP and meet other Parties. Moreover, Suriname has nominated a member to the POPs Review Committee and exchanged information in this scientific Convention group.

### *2.3.13. Relevant activities of Non-Governmental Stakeholders*

There are several NGOs in Suriname who are actively involved in the field of conservation and environment. Their activities are focused on the management of conservation areas, the protection of the environment and ecological functions, capacity-building of relevant stakeholders, and public-awareness. In general, the NGO community has no priority in focusing on POPs-chemicals, except for one NGO, “The Caribbean Institute” which promotes organic agriculture.

Another foundation that focuses on sustainable agriculture is the Foundation for Ecological Products Suriname (STEPS). It is a local organisation that aims at the social, economic, and cultural exploitation of the Interior. STEPS promotes sustainable production by local communities and builds capacity regarding the technical aspects (design of sound processing units). Since 1996, Interchurch Organization (ICCO) has a financing relationship with STEPS. Also, ProBios, active in mercury contamination from goldmining, is interested in chemicals including POPs. The World Day of Prayer movement has started to engage in waste management especially in 3R (reduce, reuse and recycling)[114].

### *2.3.14. Overview of technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, research and development – linkage to international programmes and projects*

For the monitoring of POPs, air, water, soil and human health monitoring should rely on qualitative standardised processes of data collection and analysis. In Suriname, only a few operating laboratories perform tasks in the area of chemical monitoring. Most of the laboratories are historically established for fundamental support of the primary production sector and has served predominantly for quality control purposes. Most of these laboratories are operated by governmental institutions, and therefore, have made a late shift towards including environmental factors in their test repertoire.

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[113] EEA (2001) Late lessons from early warnings: the precautionary principle 1896-2000. https://www.eea.europa.eu/publications/environmental_issue_report_2001_22

EEA (2013) Late lessons from early warnings II: science, precaution, innovation https://www.eea.europa.eu/publications/late-lessons-2/late-lessons-2-full-report

[114] http://worlddayofprayer.net/suriname-2018.html

The most advanced laboratories for testing chemical contaminants are the Chemical and Environmental Laboratories of the ADEKUS and of the Central Laboratory of VG. Both laboratories have adequate trace-analytical equipment and trained personnel to analyse trace amounts of contaminants in soil, water, and human tissue and food. The private sector companies also rely on the services of these laboratories for testing of contaminants, usually on an ad-hoc basis. Technicians of the laboratory of BOG have participated in training at the regional SC Centre CETESB in Sao Paolo in the use of different analytical techniques.

Private sector laboratories maintain equipment attuned to the specific needs of the area of work. As such, laboratories of the larger companies, e.g. SURALCO, N.V., Consolidated Industries Corporation, Suriname Alcoholic Beverages N.V., and STAATSOLIE N.V. execute their own routine analysis on their main compounds. Analysis on potential pollutants that may be released into the environment is hereby limited. Testing of surface water quality is conducted by OWTC. Their hydrology laboratory routinely tests the chemical and biological quality of surface water from channels, creeks, and rivers. The Ministry also has a laboratory to measure the atmosphere, specifically the atmospheric greenhouse gases and ozone levels. Regular air testing may occur on an ad-hoc basis by multinational and private companies.

## *2.3.15. Overview of technical infrastructure for POPs management/destruction*

### 2.3.15.1. Waste management including POPs management

Waste management has become one of the biggest challenges confronting developing countries, including Suriname. Currently most of the waste in Suriname is not recycled or recovered but just disposed of at the dumpsite. Only a few valuables are recovered from the waste including metals from e.g. vehicles or from some electronics. However, plastic/polymers containing POP-BFRs or synthetic carpets partly containing PFOS-related substances are dumped with build-up of stocks in dumpsites and associated releases.

Within the regional POPs projects, plans to close the Ornamibo dumpsite and designs to build an adjacent sanitary engineered landfill will improve the situation to some extent. Suriname has a concept Waste Act which has been waiting approval for twelve years by the DNA. This law includes a chapter about hazardous waste management. Currently, the SSB is in the process of formulating standards for waste collection and treatment.

Legislation has been made for storage and sale of pesticides (see above). It has already passed the Board of Ministers and needs to pass the National assembly to be finalised. However, there are still challenges to manage the empty pesticide containers. Activities on the elimination of pesticide stockpiles and PCBs have built some capacities for the sound management of POPs waste.

### 2.3.15.2. POPs destruction capacity and export

Currently there are no POPs destruction capacities in Suriname and POPs and POPs-containing waste is either sent to dumpsites or is exported. Activities on the export of pesticide stockpiles and PCBs have built some capacities for the export of POPs waste including the application of BC procedures.

### 2.3.15.3. Capacity and Infrastructure for contaminated sites assessment, securing and remediation

In Suriname the infrastructure and capacity for the assessment, securing and remediation of contaminated sites are not well developed. Some initial experiences have been made within the project on pesticide stockpile management. Also, an initial assessment has been made for the transformer storage site of N.V.EBS. Most of the activities, especially the analysis and assessment have been done abroad. There is no specific registration of contaminated sites and no database on contaminated sites exists.

### 2.3.16. *Identification of impacted populations or environments*

Generally, every citizen is exposed to POPs via food and indoor exposure and therefore impacted by POPs. Assessing levels in human milk or blood can reveal the POP contamination level of humans. While Suriname does not have a human monitoring activity of impacted population or environment, the laboratory of BOG developed a human milk survey with c. 40 participants. The monitoring of POPs in human milk was conducted in cooperation with the WHO reference laboratory in 2012/13.

The detected levels in the pooled human milk indicated that the average population has rather low levels of PCDD/Fs, PCBs, HCB and POPs pesticides (with exemption of the DDT group) compared to other countries (see Table 16 and Section 2.3.9). The level of the DDT group was elevated (1,392 ng/g fat). Based on the concentration detected in the milk, the mean exposure with daily 800 g milk (4 % lipid) to a breastfed infant with a body weight of 5 kg can be calculated to 0.0089 mg/kg. This value is close to the WHO TDI of 0.01 mg/kg/day. Since this is the average value, it is likely that some individuals are above the WHO TDI for DDT. To understand the content of individual samples and the related risk, the remaining individual milk samples in the laboratory of BOG should be analysed for DDT. The human milk study is primarily meant as an assessment of the background contamination of the population and does not assess any particularly impacted population.

Suriname has no overview of contaminated land (soil and groundwater). Private companies do carry out occasional soil and groundwater surveys focussed on contaminants. There are no data infrastructures set up by the Government to collect and safeguard the data on contaminated soil and groundwater.

In the past, several spills and accidents took place possibly causing soil and groundwater contamination at industrial sites, sites of medium and small enterprises, firefighting activities, releases from dumpsites and impacted privately-owned areas. Although the contaminated sites are not registered, a summary of possible contaminated sites was made based on oral information collected during the workshops, site visits, and interviews.

The most common suspect sites of soil and groundwater contamination are:

- The 22 already identified pesticide storage sites suspected for soil and groundwater contamination with organic chlorinated hydrocarbons and possibly other chemical compounds;
- The places where fire drills with firefighting foams were/are held, such as at the international airports or sites of fire accidents with associated use. These sites are suspected for PFOS and related substance- (and other PFAS) contamination of soil and groundwater with potential exposure of the population by impacted drinking water.
- Industrial sites with underground and aboveground storage tanks (UST and AST) are suspected sites for soil and groundwater contamination of the chemicals stored in the tanks;
- Industrial sites, petrol stations, car and motorcycle service stations, fitting companies, storing and car companies - selling and handling all kinds of mineral oil products - are suspected sites of soil and groundwater contamination with total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), and volatile organic hydrocarbons;
- Small and larger-scale paint spraying companies are suspected sites of soil and groundwater contamination with TPH and volatile organic hydrocarbons;
- Sites where dry cleaning took place are suspected sites of soil and groundwater contamination with chlorinated hydrocarbons;
- The places where waste is dumped (legal and illegal) are suspected sites for soil and groundwater contamination with all kinds of contaminants; and
- While implementing the NIP, assessment in human milk or blood should be considered.

To deal with the issue of suicides in the Saramacca and Nickerie districts, LVV, together with other organisations, including ADRON, started an awareness project to raise awareness and inform the local community on the proper and adequate use and storage of pesticides.

Also, open air burning of rice husks for many years have resulted in local air pollution and health effects. Many rice companies were issued permits for rice production activities in populated areas. There were no alternatives for the destruction of rice husks, so companies burn rice husks in the open or dispose of it in the river.

Due to the limited awareness of the risks involved when exposed to toxic substances, viz. POPs, not all people exposed to POPs in the workplace are using adequate Personal Protective Equipment (PPE). Examples can be observed when people apply pesticides, perform open waste burning, work at small and large-scale industries, and handle all kinds of wastes.

### *2.3.17. Details of any relevant system for the assessment and listing of new chemicals*

There are legal means to ban and prohibit POPs and most of the POPs have already been banned in Suriname. However, no system has been established to assess and determine new chemicals on the market as POPs.

For pesticides, an assessment system regarding hazard is in place. When someone wants to import pesticides to Suriname, it is required that this person send all the information of this pesticide to the Pesticide Division of LVV prior to order. The information that is required is the material safety data sheet (MSDS) and the label of the product. Currently, this information is assessed using reference data from the FAO pesticide registration Toolkit. When the laboratory of the Ministry is operational, there will also be a crosscheck (analysis) of the pesticides.

There is no specific system for the assessment of chemicals used in industrial processes or chemicals in products.

### *2.3.18. Details of any relevant system for the assessment and regulation of chemicals already in the market*

There are legal means to ban and prohibit POPs. However, no such systems have been established to determine chemicals already on the market and in use as POPs. There is no specific system for the assessment of chemicals used in industrial processes or chemicals in products.

## 2.4. *Implementation status*

Within the framework of the implementation of the SC, a range of activities have either been conducted or are currently on-going viz., the framework of the regional POPs project with a focus on the following main tasks:

- Establishing policies and regulations for the sound management of POPs;
- Environmentally Sound Management (ESM) of pesticide stockpiles and wastes;
- ESM of PCBs stockpiles and wastes;
- Promoting research and applying science, technological and innovative solutions in the sound management, reduction, destruction and elimination of POPs;
- Expanding and improving the efficiency of international cooperation.

The level of compliance with the SC requirements is compiled in Table 17

The measures for reduction with the aim of final elimination of the newly listed POPs have not started, thus compliance to the SC provision with respect to the newly listed industrial POPs will be conducted and presented in the future NIP updates. The action plans for the new listed POPs and initial POPs are presented in Chapter 3

*Table 17. Suriname level of NIP implementation status (compliance with the SC requirements) in respect to initial POPs listed in the Convention Annexes*

| Convention Article | Level of compliance | Comments |
|---|---|---|
| **ARTICLE 3 Measures to reduce or eliminate releases from intentional production and use** | For POPs pesticides see ***Section 2.3.1.*** | Pesticides on the list are prohibited from import |
| | For PCBs see ***Section 2.3.2.*** | PCB partly still in use. The amount will be inventoried within the Regional POPs project. |
| | For DDT see ***Section 2.3.5.*** | Not used anymore. |
| **ARTICLE 4 Register of exemptions** | Suriname is not registered for any specific exemptions, as listed in SC Annexes | |
| **ARTICLE 5 Measures to reduce or eliminate releases from unintentional production** | See **Section *2.3.7.*** | Slight decrease of PCDD/F releases compared to baseline inventory 2010 |
| **ARTICLE 6 Measures to reduce or eliminate releases from stockpiles and wastes** | For POPs pesticides see **Section *2.3.1.*** | The major pesticide stockpiles have been exported. Pesticide container pilot project in Nickerie is currently conducted. |
| | For PCBs see ***Section 2.3.2*** | PCBs have been exported by SURALCO.<br>PCB management component of the Regional POPs Project is in progress |
| | For DDT see ***Section 2.3.5.*** | No plans yet for the buried DDT stock at BOG. DDT is to be put on registered list of the national disaster plan |
| **ARTICLE 7 Implementation plans** | Suriname submitted its first NIP on 2 April 2012. | |
| **ARTICLE 8 Listing of chemicals in Annexes A, B and C** | As of present, Suriname has not submitted a proposal on the listing of new chemicals in Annexes A, B and C to the COP. | |
| **ARTICLE 9 Information exchange** | See ***Section 2.3.11.*** | |
| **ARTICLE 10 Public information, awareness and education** | See S***ection 2.3.11.*** | LVV is engaging in awareness sessions at secondary schools, colleges and ADEKUS on responsible pesticide use.<br>The ministry is also preparing to set up farmer fields schools again in the different districts. Here farmers will be educated in ICM, IPM and GAP principles. |

| Convention Article | Level of compliance | Comments |
| --- | --- | --- |
| **ARTICLE 11 Research, development and monitoring** | See ***Section 2.3.10.*** | |
| **ARTICLE 12 Technical assistance** | Suriname is a recipient developing country Party. Since the first NIP, Suriname is receiving technical assistance from the regional POPs project implemented by UNIDO and executed by BCRC-Caribbean | |
| **ARTICLE 13 Financial resources and mechanisms** | Financial resources are needed for the implementation of the Convention.<br>As of 30 November 2017, according to the Status of Contribution compiled by the SC Secretariat, Suriname has some unpaid pledges for prior years, 2016 & 2017. | |
| **ARTICLE 15 Reporting** | Suriname has not sent any report pursuant to Article 15 of the Convention. | Suriname plans to submit reporting for the $4^{th}$ cycle. |
| **ARTICLE 16 Effectiveness evaluation** | Suriname has participated in the WHO human milk study for the basic POPs (POPs pesticides, PCB, PCDD/F and HCB) | The levels of basic POPs (POP pesticides, PCB, PCDD/F) in human milk are low compared to most other countries. Only DDT levels are elevated. |
| **ARTICLE 17 Non-compliance** | As the procedures and institutional mechanisms for determining non-compliance are not yet approved and developed, the country's compliance cannot yet be verified | |
| **ARTICLE 19 Conference of the Parties** | Suriname has attended all SC COPs | |
| **ARTICLE 21 Amendments to the Convention** | Suriname has accepted all the SC amendments | |
| **ARTICLE 22 Adoption and amendment of annexes** | | |
| **ARTICLE 24 Signature** | Suriname signed the SC on 22 May 2002. | |
| **ARTICLE 25 Ratification, acceptance, approval or accession** | Suriname ratified the Convention on 20 September 2011. | |
| **ARTICLE 26 Entry into force** | SC entered into force for Suriname on 19 December 2011. | |

# 3. Strategy and action plan elements of the national implementation plan

**Chapter 3 addresses the formal policy statement and the implementation strategy and action plan for the NIP. The implementation strategy sets out specific action plans or strategies to achieve Convention obligations and other additional objectives set by the country.**

## 3.1. Policy statement

The United Nations Conference on Environment and Development in 1992 in Rio de Janeiro, Brazil, as well as the World Summit on Sustainable Development in 2002 in Johannesburg, South Africa, both emphasised the enormous pressure put on our environment. In Suriname there are environmental problems, among others, concerning diseases and plagues, oil spills and drainage of various waste streams in the open sea, hazardous waste stocks, decline of biodiversity and land degradation. These have led to the awareness of the need to embrace Agenda 21, and to implement a sound and sustainable environmental policy for Suriname which is embedded in the Development Plan.

The Government's national development strategy is set up in the 2017-2021 Development Plan taking into consideration the experiences, results and lessons learned in the previous Development Plan 2012-2016. The development of this plan is based on the method of strategic planning. Consequently, the Development Plan 2017-2021 must be a guideline for the policy programs and measures in the coming five years: the plan states where Suriname wants to be in 2021 and given where we are now, how we should get there. In a technical sense, it formulates the development goals and outcomes for at least the next five years and indicates the principles that will be followed in the development process. It is therefore a flexible framework, which, if followed, can ensure that different actors in the private and public sector, who operate in different branches of industry and regions of the country, are still capable of achieving the same goals together.

CM is responsible for the development of an overall environmental policy and the coordination and monitoring of all activities regarding environmental policy, but this is done in collaboration with governmental and non-governmental bodies and institutions. At present, Suriname does not have a national policy to address the environmentally-sound management of persistent toxic substances and wastes; regulations, standards, and guidelines are to be developed. However, the draft Environmental Framework Act provides a legal framework for the establishment of standards and procedures for solid waste and hazardous waste management. A Governmental Decree, proceeding from this Framework Act will be needed to incorporate more practical solutions and regulations regarding management of POPs and its waste. This will enable Suriname to develop a strategic approach to POPs management and a national policy for management of POPs.

## 3.2. *Implementation strategy*

### *3.2.1. Inter-ministerial and stakeholder coordination considering national priorities*

At the governmental level, all relevant ministries will be involved in the NIP implementation in which each ministry will have different responsibilities with respect to its function. This inter-ministerial coordinating mechanism is considered vital in addressing chemicals and waste management issues (including POPs) at large as also stressed by the national SAICM action plan.[115] Chemicals and waste have been listed and

[115] Convay T (2014) Suriname Five Year National Action Plan for Sound Management of Chemicals 2015 – 2019. 4. March 2014.

highlighted as one of the 8 national priorities.[116] Furthermore chemicals and waste and their management are important for a range of Sustainable Development Goals (SDGs) of the 2030 Sustainable Development Agenda in particular SDG 12 on sustainable production and consumption. Chemical and waste management also contribute to SDG 11 on life below water contributing to reduction of marine litter and related POPs contamination of the marine environment.[117]

To address the national priority of chemicals and waste, a coordinated approach will be adopted, with co-operation among all relevant stakeholders at all levels and sectors. Responsibilities related to the sound management of chemicals and waste as well as those involved in activities that influence chemical safety, including the private sector, industry, labour, science and public interest groups will be assigned. This inter-ministerial coordination group would address all chemical and waste related topics.

Here, also, the science–policy interfaces would be better developed. A well-established science-policy interface is critical in shaping environmental governance and sustainable development. Currently, science and other forms of knowledge are not used effectively in policymaking; policymakers do not always effectively inform scientists about their needs for scientific knowledge. In this regard, an improvement in the science-policy interface is needed and is included in the action plan.

### *3.2.2. Adequate legal, institutional, administrative and technical infrastructure*

For the implementation, an adequate legal, institutional, administrative and technical infrastructure needs to be in place. The SAICM NAP suggests that a sound management of chemicals regime considers three levels:[115]

**1. Policy level:** preparative and executive legislative actions, international co-operation on policy issues.

**2. Management level:** support legislative work, daily scientific/technical expert implementation work, and coordination/co-operation between ministries.

**3. Enforcement level:** enforcement and monitoring, co-operation/co-ordination between institutions for enforcement and supervision

The legal framework needs to consider approaches which support financing of chemicals and waste. An international guidance has been developed to support financing of chemical management.[118] Extended Producer Responsibility (EPR)[119] and Polluter Pays Principle (PPP) are approaches supporting sustainable financing of chemical and waste management (see below Section 3.6).

Additionally, an adequate technical infrastructure is needed for the management of POPs impacted waste or the analysis and monitoring of relevant POPs. Appropriate actions are proposed in the action plans below.

### *3.2.3. Synergies among related Multilateral Environmental Agreements (MEAs)*

At the international level, the COPs to the chemical conventions called for greater cooperation and coordination, and measures to be taken for a more harmonised implementation. Suriname has ratified and is a signatory to these and other international conventions and agreements and is also aware that efforts should be made for a harmonised implementation at the national level.

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[116] Republic of Suriname (2013) National Report in preparation of THE THIRD INTERNATIONAL CONFERENCE ON SMALL ISLAND DEVELOPING STATES (SIDS). Paramaribo, July 2013.

[117] Gallo F, Fossi C; Weber R; et al. (2018) Marine litter plastics and microplastics and their toxic chemicals components: the need for urgent preventive measures. Environmental Sciences Europe DOI:10.1186/s12302-018-0139-z

[118] UNEP (2015) Development of Legal and Institutional Infrastructures for Sound Management of Chemicals and Measures for Recovering Costs of National Administration (LIRA-Guidance).

[119] OECD (2016) Extended Producer Responsibility - Updated Guidance for Efficient Waste Management

Moreover, SAICM aims at the overall management of chemicals and has POPs related emerging policy issues and other issues of concern. Here, the implementation of the SC can and should facilitate the implementation of SAICM and vice versa. A first "*Suriname Five Years National Action Plan for Sound Management of Chemicals 2015-2019*"[115] has been developed. The implementation of the SC NIP and SAICM NAP should be linked and harmonised.

Hazardous waste management is an important requirement for the adequate implementation of SC and BC. However, Suriname has limited waste destruction capacity, and therefore, is currently disposing most of the chemicals, products and materials imported to the country at the end of their useful life to dumpsites. Only a minor fraction of the materials is recycled or exported. The leaching of POPs and other chemicals from landfills and dumps into ground- and surface-water and related impact to the environment and biota emphasise the need for an improvement of the situation and an integrated management approach of the import, consumption and treatment of POPs chemicals and POPs and similar chemicals in products.

Due to the challenge of POPs management and the high cost of export, the Government became aware that hazardous chemicals, which cannot be disposed of in the country, are a burden, which need to be tackled and solved. The expensive and time-consuming waste management and export efforts for PCBs, POPs pesticides, but also ODS, have alarmed the Government and the private sector to seek a more sustainable management of chemicals and products containing hazardous chemicals.

Furthermore, international efforts in protecting the Ozone Layer (Montreal Protocol/Vienna Convention) on ODS address partly the same waste categories containing POPs: air conditioners in cars or HBCD-containing extruded polystyrene (XPS) normally containing 8 % hydrofluorocarbon (HFC) as a blowing agent (often HFC-134a with high global warming potential (GWP) value of 1,300). The inventory of vehicles, electronic waste and building insulation in the framework of the SC for POP-PBDEs and the improvement of their end-of-life management can at the same time be used for a better management of ODS present in these products and wastes.

Overall, it became obvious that another policy for imports of chemicals and products containing hazardous chemicals is needed. This becomes obvious considering consumer products and related waste fractions containing to some extent new industrial POPs like plastic from electrical and electronic waste (WEEE; e-waste), car shredder residues, synthetic carpets, waste wood treated with PCP or waste oils or impregnated furniture, mattresses, synthetic carpets, textiles or paper. Such bulk wastes containing POPs, POPs-like chemicals or other hazardous chemicals have entered Suriname in thousands of tonnes over the last three decades and are currently largely disposed in dumpsites. This highlights that another waste management, extended producer/importer responsibility and import policy is needed to cope with the materials and articles containing hazardous chemicals of modern consumer society.

### *3.2.4. Addressing POPs phase out and use of alternatives within Sustainable Consumption and Production (SDG12) implementation*

In accordance with the provisions of the Article 7(3) of SC, "Parties shall endeavour to utilise and, where necessary, establish the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate". Suriname is aiming to address POPs in connection to sustainable consumption and production efforts (SDG 12). Activities towards more sustainable consumption and production (SCP) have been initiated but an action plan for SCP has not yet been developed.

The contamination of several potential recycling flows by POPs revealed the negative impact and threat for recycling and resource recovery and conservation. This includes also the negative impact of halogens in high calorific fractions for thermal recovery in cement kilns; polymer fractions such as PBDEs/BFRs in WEEE plastic and PVC and BFR polymer fraction of end-of-life vehicles. A policy approach in Suriname can be an extended producer and importer responsibility for e.g. EEE/WEEE and vehicles. This means that producers and importers of electronics and vehicles have a responsibility in the end-of-life management of these products as e.g. by the European WEEE Directive[120]. The development of a (preliminary) inventory of EEE/WEEE and the transport sector initiated by the NIP update can be regarded as a first step of addressing these waste categories. The option of a better management of resources in these material flows can contribute to SCP if waste management can be improved. Improved recycling and recovery are also opportunities for development of small and medium-sized companies and therefore for eradication of poverty and improvement of standard of living for those people becoming employed by this work.

The recycling efforts are directly linked to sustainable production, and in the case of Suriname, to "sustainable import of products". Considering the challenges of managing POPs, a policy and strategy needs to be developed within the implementation of SC and BC that POPs and similar chemicals should not be imported. There are a range of POPs with exemptions and current use often in products (HBCD, DecaBDE, SCCP, PFOS, PFOA). The further use of these POPs will generate more POPs stockpiles and waste in the future. Furthermore, there are hundreds of POPs-like chemicals[121,122], and chemicals of concern (SAICM synergy) which need to be controlled to protect human health and the environment. The implementation strategy is not to use any POPs or POP-like chemicals but the most appropriate alternatives considering green and sustainable chemistry principles. This substitution for more sustainable products is the substitution of POPs or otherwise hazardous chemicals in products with more benign substances. The alternative chemicals are best selected from a "green and sustainable chemistry "approach, which represents the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances. Fewer hazardous substances mean less hazardous waste and a healthier environment with an overall lower contamination and exposure risk. This approach is securing recycling and reuse and therefore supporting the waste hierarchy and SCP. Such efforts can also be linked to sustainable consumption of the Surinamese population. POPs and new POPs can be used here as an awareness-raising tool for stakeholder groups.

## 3.3. *Action plans, including respective activities and strategies*

### *3.3.1. Activity: Institutional and regulatory strengthening measures*

In Suriname, the issue of hazardous chemicals and wastes (including POPs) is of great concern and a priority. [123] However, there is no comprehensive and streamlined legislation for chemicals management and waste management in the country.[124] Notwithstanding, some aspects of legislation in these areas are found in various laws within the country e.g. the Pesticides Act. The SC requires Parties to take certain measures to achieve the objective of the Convention. Furthermore, other ratified chemical Conventions should be considered viz. RC and BC. Moreover, SAICM aims at an overall management of chemicals and has POPs related emerging policy issues and issues of concern. Here the implementation of the SC can facilitate the implementation of SAICM and vice versa. The first "*Suriname Five Years National Action Plan for Sound Management of Chemicals 2015-2019*" has been developed.[115]

A successful implementation of the Convention in Suriname would therefore attempt an integrated approach with SAICM and BC and integration of some related provisions into the current institutional and regulatory framework for managing chemicals in the country. The most readily available tool for the Government to ensure adequate flow of information on hazards and safe use, handling and transport of chemicals on the market is the national adoption of the internationally agreed information system found in

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[120] http://ec.europa.eu/environment/waste/weee/index_en.htm

[121] Scheringer et al. (2012) How many Persistent Organic Pollutants should we expect? Atmos Pollut Res 3, 383–391.

[122] Muir DC, Howard PH (2006) Are there other persistent organic pollutants? A challenge for environmental chemists.Environ Sci Technol. 40(23):7157-7166.

[123] Ministry of Foreign Affairs and NIMOS (2013) Republic of Suriname national report in preparation of the third international conference on small island developing states (SIDS). Paramaribo, July 2013.

[124] Convay T (2014) Suriname Five Year National Action Plan for Sound Management of Chemicals 2015 – 2019. 4. March 2014.

the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). Introduction of this system on chemical labelling and safety data sheets will also be an important step that most Governments can take to raise enterprise, worker and public awareness of chemical risks. However, GHS does not adequately address chemicals in products and wastes, which is a major issue and problem for POPs and other hazardous chemicals in products and related waste management.

The POPs action plan aims at improving the existing institutional and regulatory framework in Suriname and facilitating chemical and waste management. One objective is to support the development of an overall framework of chemical and waste management by cooperation with SAICM and BC implementation activities and synergy with the Minamata Convention on their facilitation. Another objective is to prevent the production and use of pesticides and industrial chemicals that are potential POPs or highly hazardous pesticides (SAICM issue of concern) or hazardous chemicals in products (CiP). Detailed activity related to POPs pesticides and highly hazardous pesticides are compiled in the action plan for POPs pesticides in Section 3.3.3.

Data on the import and export of chemicals are available at Customs and other (governmental) institutions such as NIMOS, LVV, and VG – which have specific tasks such as to collect import and export data, to comply with international regulations or commitments. These institutions started to collaborate with Customs to develop a unified database.

The current action plan seeks to support the development of a larger institutional framework for chemical management (synergy with SAICM) and waste management (synergy with BC). To support the larger framework of chemical and waste management also considers that chemicals and waste is one of eight priorities of Suriname.

*Table 18. Action plan institutional and regulatory strengthening measures*

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| **Cooperation between institutions** | | | | |
| To coordinate activities of the different institutions in the administration and collaboratively monitor chemical and waste management including implementation of the SC NIP and SAICM NAP and uses of pesticides | Re-establish a National Chemical Committee for chemical and waste management.<br><br>Committee coordinate implementation of NIP and overall management of pesticides | Memorandum of Understandings<br><br>Identified gaps for the coordination and how to address gaps (report)<br><br>Number of meetings | 2 years | CM<br>NIMOS<br>FIN/Customs<br>LVV<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police |
| Increased capacity of staff in CM for chemical and waste management | Needs assessment of staff in CM for chemical and waste management considering SC NIP and SAICM NAP implementation tasks<br><br>Employment of staff in CM<br><br>Capacity-building of staff (in combination with following page) | Report on needs assessment<br><br>Staff employed and CM enlarged<br><br>Staff trained. | 1 year | CM |

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| To assess and set responsibilities of ministries and other authorities for the life cycle management of POPs and other hazardous chemicals (SAICM synergy) and wastes (Basel synergy) | Assess responsibilities and capacity of institutions for life cycle management of POPs and other hazardous chemicals and wastes and related gaps and needs assessment.<br><br>Addressing gaps and improvement of the framework for life cycle management of POPs and other hazardous chemicals and waste.<br><br>Capacity building of institutions for life cycle management of POPs, chemicals and waste | Gaps assessment report and suggestions for improvement<br><br>Improved legal framework<br><br>Trainings and workshops | 3 years | CM<br>NIMOS<br>FIN/Customs<br>LVV<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police |
| To make geodata available for the different stakeholders working on site assessment | Develop cooperation between institutions managing geodata archives (GMD, DBK, CBL etc) | Archives are safeguarded and accessible. Data exchanged | 1 year | NIMOS<br>GMD<br>DBK<br>CBL |
| **Legal and policy framework** **(legal/regulatory activities for individual POPs are included in respective action plans)** | | | | |
| Assessing and harmonising existing legal/policy framework on POPs and hazardous chemicals (Synergy SAICM NAP) | Compile and assess existing legal instruments for the life cycle management of POPs (and other hazardous chemicals) in the country.<br><br>Review existing legislations on management of POPs and other hazardous chemicals and waste in selected other countries.<br><br>Improve or develop an overall chemical regulatory framework including the assessment of chemicals in use and chemicals for registration for their POPs and other hazardous properties. | Compiled and updated inventory. Proposals for legislative and policy review.<br><br>Draft regulation.<br><br>Chemicals law adopted | 5 years | CM<br>NIMOS<br>FIN/Customs<br>LVV<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br>Private sector |
| Establish the Global Harmonised System (GHS) in Suriname (Synergy with SAICM NAP) | Drafting of regulation/decree<br><br>Stakeholder consultations on decree and adoption speed<br><br>Translation of GHS and additional national guidance materials development<br><br>Development and approval of national implementation strategy and associated training and awareness-raising plan<br><br>Public notification of regulation/decree issued by government<br><br>Implementation of GHS and related labelling | Draft law/regulation/ decree on national GHS adoption<br><br>GHS documents in Dutch<br><br>Final GHS implementation strategy formally adopted by the Government<br><br>GHS implemented | 4 years | LVV<br>SSB<br>FIN/Customs<br>NIMOS<br>Private sector |

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| Inform and capacitate institutions and stakeholders on regulations and on enforcement and compliance of regulations on POPs and other hazardous chemicals (SAICM synergy) | Development of information materials on regulatory requirements for the respective POPs tailored for institutions and industrial and other stakeholders.<br><br>Information and education on regulatory issues for stakeholder groups for individual POPs | Information materials<br><br>Workshops organised | 5 years | CM<br>NIMOS<br>FIN/Customs<br>LVV<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police |

## 3.3.2. Activity: Measures to reduce or eliminate releases from intentional use

In Suriname there is no intentional production of POPs chemicals. However, there are several POPs in use including POP-PBDEs in articles or PFOS in stocks such as products and articles. For instance, Lindane is used for second line treatment of head lice. Furthermore, recently listed POPs such as SCCPs and DecaBDE have a range of exemptions, which have not yet been assessed for Suriname in the current NIP update and are likely used in some processes and are certainly present and used in articles and products. Also apart from PCBs, which are still used in electrical equipment, there is no legal intentional use of POPs chemicals in Suriname. Certain POPs pesticides as well as PCBs may be used illegally. This is either from existing stockpiles or from illegal importation. It is therefore necessary to identify measures to ban and prohibit the illegal importation and use of POPs pesticides and the illegal use of PCBs. Article 3 of the Convention summarises activities that need to be put in-place to reduce and eliminate releases from intentional production. These activities include legal and administrative measures. This action plan presented below identifies measures to reduce or eliminate releases from intentional production and use of POPs.

*Table 19. Measures to reduce or eliminate releases from intentional use*

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| Assessment of current use of POPs and reducing and eliminating releases and use of POPs | Update inventory of annex A and B chemicals imported and used in Suriname considering also the recent listed SCCP and DecaBDE and possibly PCP. | Database of Annex A & B Chemicals currently in use in Suriname | 5 years | CM<br>HI&T<br>Relevant Sector |
| | Analyse pattern of usage of annex A and B chemicals | Use pattern and processes of POPs identified | | |
| | Control and reduce release | | | |
| | Phase out of current use of identified POPs and substitution (PFOS and likely SCCPs) | Substitution by more sustainable chemicals and non-chemical alternatives | | |
| Restricting or prohibit import of Annex A & B chemicals | Evaluate the need for any exemption<br>Develop regulatory framework to restrict or prohibit | Prohibition regulation | 3 year | CM<br>Relevant sector<br>HI&T |

### *3.3.3. Activity: Production, import and export, use, stockpiles export and waste of Annex A POPs pesticides (Annex A, Part I chemicals)*

There has not been any previous production of the listed POP pesticides (initial POPs pesticides and pesticides listed in 2009 and 2011) in Suriname. From the POPs pesticides listed in the Convention only chlordecone and pentachlorobenzene have not been banned.

PCP listed in 2015 has not been assessed in this NIP update and therefore there is the need for assessment and control in the future. Activities required are included in this action plan. For successful implementation of the strategy, the gaps in the current system should be addressed.

The first gap to be addressed is that pesticides need to be registered in a comparable format based on its location and use.

The second gap is that information about the risks of pesticides to the environment and human health should be analysed to ensure the safety of farmers, consumers, and pesticide handlers.

The third gap is the lack of a system of liability and enforcement to ensure the proper handling, storage, and disposal of pesticides.

In Suriname the existing legal instruments have limited focus on the monitoring of pesticide use. LVV has legal tools to administer pesticides after its registration at the point of entry until their usage and/or disposal. The registration system should be based on location and amount of pesticide used.[125] To adequately assess the risk associated with pesticides, LVV should have a protocol to engage in pre-testing of new pesticides before being released for wider use. Pre-testing should be approached as a routine activity that is the legal responsibility of the importer under the supervision of LVV. With most insecticides, such pretesting is conducted. In this way, the Ministry can assess the effects of pesticides on secondary crops and existing biodiversity. While this is part of the legislation, there is a lack of facilities for practical implementation. A second aspect of risk assessment is residue analysis. Residue analysis can be used as a way of enforcement based on new legal regulations. Finally, emergency measures and new regulations should be developed to address the liability and redress in case there is a calamity with pesticides that are harmful to human health and/or the environment. LVV is collaborating with VG on a disaster plan for chemicals in Suriname.

Because the Government possesses a limited amount of resources, the liability and redress - in terms of non-compliance with regulations on risk-assessment, storage, transportation, handling and use of pesticides - should be the responsibility of the user and supplier. Given the onus of liability on the user/supplier as stated in the 2005 Pesticide Act, further regulations should support a clear system in liability and redress and include enforcement clauses. Furthermore, clear guidelines should be developed for the storage, disposal, and transportation of pesticides. A draft legislation for the storage part has already been developed awaiting enforcement from DNA.

The following action plan details activities to be undertaken with respect to the production, import and export, use, stockpiles and waste of Annex A Part I pesticides.

Overall objective of the NIP Strategy and Action Plan is to ensure a safe use of pesticides for environmental and human health in Suriname. The strategy that is currently being executed is based on:

1. Use of environmentally-safe pesticides
2. Responsible and safe use of potentially hazardous pesticides
3. Banning the use of extremely hazardous chemicals and

[125] The latter is linked to the area of the crop under production, the data for which can be acquired from the Statistics division of LVV. For instance, a farmer can only acquire a certain amount of pesticide from the supplier based on the area under production. Such a system can be easily set up with Geographic Information Systems (GIS) which will enable geospatial analysis and comparison of data. This GIS system will serve as the main system for pesticide registration and management. Currently pesticide inspectors are educated and installed (16 from the 120 extension workers) so that these kinds of inspections and monitoring of pesticides can be conducted.

4. Disposal of hazardous pesticides.

### Improving technical capacity for improved management of pesticides

Apart from LVV, the technical capacity for understanding the risks of the use and handling of pesticides is limited. From interviews conducted, it became apparent that suppliers have limited knowledge about the risks to human health associated with the storage of pesticides. Suriname should design a training program that is specifically focused on translating the message from the guidelines and legislation to the different stakeholders, e.g. customs, suppliers, distributors, transporters, farmers. It is important to train trainers so that they can conduct refresher courses on a frequent basis. In addition, it should be required by the Government that sales persons should be trained to obtain a permit which is currently under development within the empty pesticide management pilot project.

Furthermore, the current laboratory infrastructure needs to adhere to international standards. Laboratories should have standard laboratory equipment, an institutionalised system with full-time and trained personnel, and suitable physical infrastructure. Not only training of personnel is important, but also the instalment of a system of validation of data with reference to other similar laboratories.

### Increasing awareness and information dissemination

The general awareness on the nature and use of pesticides can be improved in Suriname. Information about pesticides should be translated into different messages that target the consumers. By using film, pamphlets, radio and other suitable awareness materials, the stakeholders can be informed about the risks associated to human health due to uncontrolled use of pesticides in food. Another focus of this campaign should be on the use of personal protective equipment when using pesticides in the household and while farming. The campaign should be conducted for the duration of at least two years after which sensitisation can occur at least twice yearly.

An information website should be established if more technical information is required. This website[126] should provide general information on all the pesticides used in Suriname, their use and risks to human and environmental health. Ministry of Health has a toxicology focal point that should play an active role.

Also, the obligations of suppliers, transporters, and farmers can be made public along with pressing regulatory issues.

*Table 20. Action plan import and export, use, stockpiles, and wastes of POPs pesticides (Annex A) and highly hazardous pesticides (HHPs)*

| Objective | Activities | Indicator | Implementer | Time frame |
|---|---|---|---|---|
| Improvement of the legislative framework and policy. Develop subsidiary regulations on liability and redress (revise) to the 2005<br>Pesticide Act | Develop subsidiary regulations on liability.<br><br>Update existing regulations to restrict/address all listed pesticides by banning and regulating new/all listed POPs pesticides | Updated legislation, regulation and list of banned pesticides<br><br>Subsidiary regulations approved by stakeholders and by Council of Ministers | CM<br>LVV<br>HI&T | 3 years |
| | Improve regulatory measures to combat illegal traffic of counterfeit pesticides | Regulatory measures in place | LVV<br>HI&T<br>FIN/Customs<br>NIMOS | 3 years |

[126] The registered pesticide list is available on the CAHFSA website.

| Objective | Activities | Indicator | Implementer | Time frame |
|---|---|---|---|---|
| To improve the use of PSMS for the analysis of existing data on the import, trade and use and non-use of pesticides. | Improvement of POPs Pesticide inventory considering FAO PSMS (overall stockpiles; avoiding reoccurrence of obsolete pesticides stocks) | In-house training completed and PSMS is used | LVV<br>HI&T<br>FIN/Customs<br>NIMOS<br>CM | |
| Maintain and improve technical capacity for better life cycle management of pesticides | Assess technical guidelines for storage, transportation, handling, disposal and use of pesticides written by NIMOS. | Final guidelines approved by stakeholders and published | SSB<br>LVV | |
| | Establish pesticide disposal infrastructure. Select and renovate ICC | ICC (or other) is rehabilitated up to the international standards | LVV<br>OWTC<br>NCCR | 1 year |
| | Establish, strengthen field data gathering and surveillance system including already existing system GAP (Good Agricultural Practice) | Project implementation plan<br>Monitoring equipment and<br>GPS devices purchased | LVV<br>NGO's | 1 year |
| | Establishing of an empty containers collection and management system, with specific attention to address the use of pesticide empty containers (3rd phase FAO project) | Number of collection centres<br>Tonnes/share collected and managed | LVV (responsible)<br>NCCR, CM | 2 years |
| | Emergency Response Plan (ERP) and establishing capacity to address emergencies and disasters related to pesticides (poisoning, spillage, and fires contamination). | Poison centre established and operative<br>Number of trained ERP consultants that can organise information campaigns | LVV<br>VG<br>NCCR | 2 years |
| | To improve field infrastructure for testing pesticides on their risks to the environment | Regular field tests executed and analysed<br>Number of tests carried out<br>Field team trained and equipped | ADEKUS<br>CELOS<br>ADRON<br>FAI | 2 years |
| Controlled pesticide trade | Organise training for selected stakeholders and implement certification for pesticide trade and organise with permitting department that only certificated companies can obtain a permit | Participants obtained certificates and are actively involved in pesticide management | LVV<br>NIMOS | 2 years |

| Objective | Activities | Indicator | Implementer | Time frame |
|---|---|---|---|---|
| To provide education by a basic training package with all necessary information for stakeholders (customs, farmers NGOs and the public) to adequately life cycle, manage pesticides including trade, movement and use | Education of custom, phytosanitary inspectors and companies on legal status of pesticides and counterfeit products for strengthening the inspection on pesticides (market survey, sales, storage, usage and disposal including counterfeit and illegal pesticides). | Report on baseline assessment<br><br>Number of subscribers (companies, permitting authorities and trainers for trainers)<br><br>Training packages designed for various stakeholders) | LVV<br>NIMOS<br>OWC<br>LB | 2 years |
| | Education of policy makers, Non-Governmental Organizations (NGOs) and citizens on health hazards of POPs pesticides and Highly Hazardous Pesticides (HHPs) and the benefits of IPM and organic farming | Number of educated stakeholders | | 2 years |
| | Education of farmers on POPs pesticides, HHPs, counterfeit pesticides and the use of IPM and organic farming | Number and share of educated farmers | | 2 years |
| Assessment of POPs pesticides and HHPs (SAICM Synergy) and alternatives used and implementation of substitution and IPM and organic farming. | Compilation of information on alternatives to POPs pesticides and HHPs (SAICM Synergy) including a risk assessment for POPs pesticides and HHPs and their alternatives including the risk to humans and biota and ecosystem indicators | Report on assessment on alternatives to POPs and HHPs. | LVV<br>LB<br>RO<br>Private Sector<br>NGOs | 2 years |
| | Supporting implementation and research on IPM/IVM (Integrated Vector Management), including the use of alternatives as a measure for reducing POPs pesticides and HHP use | Shift to IPM/IVM (report) | LVV<br>Farmer organisations<br>ADEKUS | 5 years |
| | Selection of the most sustainable alternative chemicals and non-chemical solutions in the different applications and incl. promotion of organic farming. | Report on alternatives<br><br>Target for organic farming | LVV<br>Farmer organisations<br>ADEKUS | |
| | Education and capacity-building on alternatives and organic farming and implementation | Number of farmers educated<br>Share of alternatives and organic farming | LVV<br>Farmer organisations<br>ADEKUS | |
| Established analysis and monitoring of POPs, HHPs (SAICM synergy) and other pesticides (products, food, environment, exposure) | To improve the laboratory facilities and personnel for testing pesticide residues (LVV, BOG and ADEKUS) for adhering to an acceptable national safety level | Laboratory capacity established and accredited<br><br>Routine results from residue testing available<br><br>Cross reference other regional laboratories | ADEKUS<br>VG<br>OWTC<br>LVV<br>VG/BOG | 2 years |

| Objective | Activities | Indicator | Implementer | Time frame |
|---|---|---|---|---|
| | Develop agreements with institutions and collaboration in regular laboratory testing of pesticides (BOG/LVV/ADEKUS) and field testing (ADEKUS and other institutions) for support to the adequate and cost-effective monitoring and management of pesticides | Memorandum of Understanding (MOU) developed and implemented<br><br>Identified and reported possible cooperation aspects that lead to cost-effective monitoring | LVV<br>VG/BOG<br>ADEKUS<br>CM | 2 years |
| | Assessment of occupational exposure to POPs pesticides and HHPs | Report on occupational risk | LVV<br>LB<br>VG/BOG | 3 years |
| Established capacity of risk and socio-economic assessment | Development of knowledge, capacity, tools and indicators to better assess the risks and socio-economic impact of POPs/HHPs | Experts or institution with capacity in risk and socio-economic assessment | LVV<br>NIMOS | 2 years |
| The action plan for POP-pesticide-contaminated sites is integrated in the general action plan on POPs-contaminated sites in Section 3.3.11 | | | | |

### 3.3.4. *Activity: Import and export, use, identification, labelling, removal, storage, and disposal of PCBs and equipment containing PCBs (Annex A, Part II Chemicals)*

The overall objective of the strategy and action plan is to have PCB-free equipment and materials being used in Suriname. Acknowledging that currently PCBs are found in electrical devices and that alternatives to these devices are being used in Suriname, the strategy and action plan for eliminating the use of PCB-containing and contaminated equipment should focus on the proper management and phasing-out of this equipment.

While the major focus of this action plan is on management of PCBs, PCNs are also addressed in this action plan. PCNs have been listed in the Convention in Annex A and C in 2015. PCNs have been used in the same application as PCBs but mainly in the 1930s to 1960s: In closed application mainly in capacitors and less in transformers and hydraulic oils (UNEP 2017)[127]. PCNs have also been used in the same open applications as PCBs (additives in paints, sealants, rubber, cable sheets, as metal-working fluids). The total production was c. 150,000 tonnes (10 % of global PCB production). Due to the lower use volume and the earlier production/use, industrial PCNs have much lower overall relevance compared to PCBs and it is unknown if any relevant amount of PCNs are present in the former uses. PCNs can be managed within the framework of PCB management. They are detected by the chlorine test kits for screening of PCBs in transformers and would be integrated in the instrumental screening for chlorine-positive samples.

SCCPs have been listed recently at COP8 (05/2017) as POPs with a range of exemptions. SCCPs have substituted PCBs and PCNs in a wide range of open applications (e.g. paints, coatings, sealants, plastic additive/flame retardant, rubber, lubricants, and metal-working fluids). Since SCCPs will need to be addressed in the next NIP update and since the use is in these applications, an inventory of open applications would address all three POPs.

To adequately implement such a strategy and action plan it is necessary that a comprehensive inventory is conducted together with risk assessments on both electrical devices and other sources of PCB, PCNs and SCCPs in 'open applications'.

[127] UNEP (2017) Draft guidance on preparing inventories of polychlorinated naphthalenes. UNEP/POPS/COP.8/INF/19.

The proposed activities define specific actions with respect to managing PCBs/PCNs, both in the short and the long term in a manner that is consistent with the obligations of the SC. The overall objective is a reduction and ultimate elimination of PCB use, the prevention of releases of the chemical into the environment, and to provide for environmentally-sound disposal or final elimination of PCB waste. The strategy and action plan focus on provisions and measures in the areas of: legislation, institutional setting, technical capacity, life cycle management, alternatives as well as awareness.

*Table 21. Action Plan import and export, use, identification, labelling, removal, storage and disposal of PCBs and equipment containing PCBs (Annex A, Part II chemicals)*

| Objective/aim | Activity | Indicators | Time frame | Implementer |
|---|---|---|---|---|
| Development and implementations of legislative framework, policy and measures for control and management of PCBs and PCNs in closed and open applications (equipment, materials and wastes). | Assessment of the performance of regulations in managing and eliminating PCBs/PCNs in use and out of use, ban the importation and strengthening the current legislative package. | Amended State Order Negative List 1999<br><br>Approval by Council of Ministers | 1 year | CM<br>NIMOS<br>FIN/Customs<br>NH/DEV<br>Energy Authority<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br>Private sector<br>N.V. EBS<br>STAATSOLIE N.V. |
| | Establishing penalties/fines for the improper management of PCB/PCN-containing equipment. | Penalties and incentives are established | 2 years | |
| | Developing and implementing incentives for electric utilities to comply with the phase-out of PCBs/PCNs, | | | |
| | Defining a National PCB/PCN-Elimination Plan, best within a National Hazardous Waste Management Plan and, define the responsibilities for institutions and companies for PCB/PCN-containing wastes management and disposal | National elimination plan | 2 years | |
| | Strengthening the control/ inspection for PCB/PCN-containing equipment still in use, and for interim storages and disposal facilities. | Inspectors trained on use of equipment | 2 years | NH/DEV<br>LB<br>NIMOS<br>Police<br>Fire Brigade<br>N.V. EBS |
| Development/update of a PCB/PCN inventory in closed and PCB/PCN and SCCP inventory in open applications where relevant | Completing inventory of PCB/PCN-containing equipment (in use and out of use). | Inventory of transformers, capacitors and other equipment | 3 years | CM<br>NIMOS<br>NH/DEV<br>Energy Authority<br>NCCR<br>STAATSOLIE N.V.<br>Private sector<br>N.V.EBS |
| | Assessment of the past use of PCBs/PCNs and current/past use of SCCPs in open applications (e.g. sealants, paints, rubber, chloroprene, plastic additive, industrial oils) in the country and, where relevant, developing inventory of PCBs/PCNs and SCCPs in open applications. | Assessment of use (report).<br><br>Inventory of open applications | 5 years | CM<br>ADEKUS Private sector (paint, plastic, lubricant)<br>Oil importing companies |

| Objective/aim | Activity | Indicators | Time frame | Implementer |
|---|---|---|---|---|
| | Assessment of waste oil management and use and inventory of potentially PCB-/PCN- and SCCP-contaminated waste oils. Assessment of risk of (waste) oils for food, feed and environmental pollution. | Monitoring/inventory report | 3 years | CM<br>NIMOS<br>Private sector VSB<br>ASFA |
| | Developing and regularly updating a database for PCB/PCN-containing equipment (in use and storage) and open applications (e.g. buildings/constructions) | Database | 3 years | N.V.EBS<br>NH/DEV<br>Energy Authority |
| Life cycle management (handling, storage, transport and disposal) of PCBs/PCNs, PCB/PCN-containing equipment, open applications and PCB/PCN-containing and contaminated wastes | Assessing the current situation and improvement needs of interim storage and disposal for PCB/PCN-containing equipment and wastes | Assessment report | 1 year | CM<br>NIMOS<br>NH/DEV<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br>Energy Authority<br>Private sector<br>N.V.EBS |
| | Establishing ESM procedures for PCBs/PCNs equipment and wastes considering existing technical guidelines. | Authorities and staff trained | 2 years | |
| | Establishing inspection/control on the handling, storage, transfer and disposal of PCB/PCN-containing equipment and PCB/PCN-containing wastes | Inspectors trained<br><br>Inspections conducted (reports) | 2 years | |
| | Phase-out PCB/PCN in closed and open applications and monitoring of the progress | Phase-out of equipment by 2025.<br>Documented management and export | 6 years | |
| | Environmentally-sound management and disposal of PCB/PCN-containing equipment and waste | Disposal of equipment by 2027 | 9 years | |
| Awareness, education and training of stakeholders (policy makers; customs, related industries, NGOs and the public) on PCBs/PCNs in closed and open applications (linked to the awareness on chemicals in products (SAICM synergy)) | Awareness/education of policy-makers and other stakeholders on health hazards of PCBs, PCNs and SCCPs and the related risk for humans, environment and food. | Number of awareness activities conducted | 2 years | FIN/Customs<br>NIMOS<br>N.V.EBS<br>Media outlets |
| | Strengthen the inspection-capacity for customs and other competent authority (import, use; mark/sales, storage, disposal). | Customs and inspectors trained (number of trainings; participants) | 2 years | |
| | Education of utility sector, maintenance workers and industry owning transformers, capacitors and other PCB/PCN-containing closed equipment and open applications on PCBs, PCNs and alternatives.<br>Education of citizens and NGOs on PCBs and PCNs including open applications relevant for consumers (paints and sealants). | Workers and stakeholders trained (number of trainings; participants) | 1 year | |
| Established monitoring and analysis of PCBs and PCNs (closed and open applications, environment, food, exposure) | Monitoring and analysis of PCBs and PCNs for closed and open applications (see above) | PCB/PCN inventory in closed application | 3 years | N.V.EBS<br>ADEKUS VG/BOG<br>Regional/international collaborations |
| | Monitoring of occupational exposure (maintenance and management/remediation staff) | Monitoring data of potentially exposed staff | 5 years | |

| Objective/aim | Activity | Indicators | Time frame | Implementer |
|---|---|---|---|---|
| | Monitoring of PCBs/PCNs and SCCPs (human, environment biota, imports, food) by own capacity or regional/international collaboration | Monitoring data | 3 years | |
| Assessment and promotion of sustainable alternatives used for PCBs, PCNs and SCCPs in closed and open applications | Compilation of information on alternatives in closed and open applications of PCBs/PCNs and SCCPs and assessment of alternatives used | Reports (compiling available information from e.g. POPRC) | 2 years | ADEKUS<br>NIMOS<br>N.V.EBS<br>NH/DEV |
| | Education on alternatives of PCBs/PCNs and SCCPs in closed and open applications | Trainings conducted (numbers of participants) | 3 years | |
| | Promotion of most sustainable alternatives in closed applications considering chemical and energy aspects | Selected alternative equipment (e.g. ecolabel; Green public procurement) | 5 years | |
| | Promotion of the most sustainable alternatives in (former) open applications of PCBs/PCNs and SCCPs | Selected alternatives (e.g. ecolabel) | 5 years | |
| The action plan for PCB/PCN-contaminated sites is integrated in the general action plan on POPs-contaminated sites in Section 3.3.11 | | | | |

### *3.3.5. Activity: Import and export, use, stockpiles, and wastes of POP-PBDEs (Annex A, Part IV & V chemicals), HBCD and HBB (Annex A, Part I chemical)*

According to the POP-PBDE inventory POP-PBDEs listed in 2009 have been imported in electrical and electronic equipment and in vehicles and possibly other goods. Therefore, they are present in stocks at consumer levels or as wastes (see Section 2.3.3). The amount of POP-PBDE is considerably higher than the current PBDE inventory since DecaBDE has been listed as a POP in 2017 and is present in these articles and wastes in considerably higher concentration.

The action plan focuses on setting actions and measures whose implementation will lead to managing and controlling POP-PBDE-containing products. For managing PBDEs, the life cycle management (import, export, use, recycling, destruction) of POP-containing articles/products and waste, needs to be developed, especially for EEE/WEEE and ELVs. In addition, HBCD and to a lesser extent PBDEs are used in insulation of housings (polyurethane and polystyrene).

For these three large material and waste flows, resource, recovery, and recycling need to be considered, following the waste management hierarchy for the recovery of resources. At the same time, pollutants such as PBDEs, HBCD and other POPs/PBTs (Persistent, Bioaccumulative and Toxic Chemicals) need to be phased out of the recycling where feasible.[128] PBDEs might also be partly included in polyurethane or textiles imported furniture from North America, which also needs further assessment.

[128] Stockholm Convention (2017) Guidance on best available techniques and best environmental practices for the recycling and disposal of articles containing polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants; Draft 2017.

*Table 22. Action plan elimination and management of POP-BFRs (PBDEs, HBCD and PBB[129]) including timelines, responsible authorities and stakeholders*

| Objectives | Activities/tasks | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Established regulatory framework for the management of POP-BFRs and related articles and waste categories | Inclusion of POP-PBDEs, PBB and HBCD in list of banned or restricted substances | POP-PBDE, PBB and HBCD restricted | 1 years | CM<br>NIMOS<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>LB<br>JP<br>RO<br>Private sector |
| | Assessment of regulatory frameworks for these POPs and the products and wastes containing these substances. | Overview of international regulations compiled | 2 years | |
| | Development of regulatory framework for EEE/WEEE management | Regulatory frameworks for EEE/WEEE developed | 5 years | |
| | Development of a regulatory framework for vehicles management[130] (importation, end-of-life management). | Regulatory frameworks for vehicles developed | 5 years | |
| | Development of a regulatory framework for HBCD in insulation. | Regulatory frameworks for HBCD insulation foams developed | 5 years | |
| Updated and refined inventory of POP-PBDEs including DecaBDE and HBCD-containing articles and wastes and updated databases for information management | Update POP-PBDE inventories considering DecaBDE (and other updates if necessary) | Updated inventory report | 2 years | CM<br>NIMOS<br>ABS<br>ADEKUS<br>Consultant |
| | Develop dynamic MFA/SFA inventory for POPs/PTS (and resources) in EEE/WEEE, vehicles, and insulation in construction. | Dynamic substance flow analysis of POP-BFR-containing products and waste (report) | 3 years | |
| | Data management system for product and waste categories containing BFRs (for general waste management) | Databank for EEE/WEEE, vehicles, established | 2 years | |
| Sound Life Cycle Management of POP-PBDE and HBCD-containing product and waste categories (EEE/WEEE, end-of-life vehicle, insulation foam) and integrate in the larger framework of plastic/polymer management | Compilation of information of management for POP-BFR-containing products and waste including fate of other pollutants. | Report | 2 years | CM<br>NIMOS<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br>RO<br>NH/DEV<br>WEEE owners<br>Private sector |
| | Assessment of management, recycling and destruction option of waste categories containing POP-BFR (WEEE; ELV, insulation foam, furniture). | Assessment report | 2 years | |
| | Compile information on safe handling of POP-BFR polymers in EEE, ELV, and insulation foam etc. and use available guidelines or develop national guidance for the management of the waste and the resources. | Report and selected guideline or developed guidance | 2 years | |
| | Development of sound management (financing, collection, storage, treatment considering the waste hierarchy) of POP-BFR-containing plastic and other polymer in EEE/WEEE within the framework of hazardous substance management in EEE life cycle | EEE plastic and POP-PBDE management is addressed within WEEE management | 3 years | |

[129] HBB have been produced and used in minor amounts (approx. 5000 t) in the 1970s mainly in the ÚS and are not considered relevant today. HBB is included in the monitoring action plan to verify this.

[130] see e.g. EU ELV directive.

| Objectives | Activities/tasks | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| | Development of sound management of POP-BFR-containing plastic and other polymers in end-of-life vehicles within the framework of hazardous substance management in the life cycle of ELV | ESM of plastic and polymers within ELV management established (report) | 3 years | |
| | Development of sound management of POP-BFR-containing plastic and other polymer in buildings and construction within the framework of POPs (PCBs, PCP, POP-pesticide in wood, SCCPs) and hazardous substance management in buildings and construction.<br><br>Development of sound management of POP-BFR-containing plastic and other polymer in other uses found relevant | ESM of plastic/polymer from construction & demolition waste (report) | 3 years | |
| | Identify destruction and energy recovery options for POP-BFR-containing waste.<br><br>Develop phase out/destruction options for identified POP-PBDEs sources. | Phase-out/destruction options identified.<br><br>Phase-out/destruction options programmes in place | 5 years | |
| Assessing and selecting the most sustainable alternatives to POP-BFRs in used/exempted applications | Compilation of information on alternatives to HBCD-containing EPS/XPS insulation (see SC HBCD BAT/BEP guidance; POPRC).<br><br>Compilation of information on alternatives to DecaBDE (considering activities of POPRC; UNEP BAT/BEP group).<br><br>Education and capacity-building on alternatives assessment.<br><br>Selection of the most sustainable alternative chemicals and non-chemical solutions in the different applications.<br><br>Phase in of sustainable alternative chemicals and non-chemical alternatives. | Most sustainable alternatives to POP-BFRs (HBCD and DecaBDE) in used/exempted applications are assessed and selected | 3 years | ADEKUS<br><br>NIMOS<br><br>Private sector |
| (Applying BAT/BEP if HBCD or DecaBDE in exempted uses to ensure the controlled use and ESM along the life cycle) | BAT/BEP in use and ESM of HBCD EPS/XPS in construction.<br><br>BAT/BEP if DecaBDE is used in exempted uses<br><br>BAT/BEP in recycling of POP-PBDE-containing plastic/polymers (please note that DecaBDE does not have a recycling exemption)<br><br>Labelling of products containing HBCD and DecaBDE | BAT/BEP applied to ensure the controlled use and ESM along the life cycle | 3 years | Industrial stakeholders |

| Objectives | Activities/tasks | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Awareness of major stakeholders on POP-BFR-containing products and waste created (integrated in the overarching framework on awareness of "Chemicals in Products" and "Management of hazardous chemicals in the life cycle of EEE" (SAICM synergy) | Develop awareness-creation strategy on impact (health, recycling, environment) of POP-BFRs and other hazardous chemicals in the life cycle of EEE, vehicles, buildings, textiles and other impacted product categories.<br><br>Developing awareness-raising materials on POP-BFRs and other hazardous substances in EEE, ELVs, buildings etc.<br><br>Awareness-raising campaigns for stakeholders (policy makers, authorities, industry, recyclers, research and public) on POP-BFRs within a larger awareness campaign on chemicals in products, marine litter and SCP.<br><br>Awareness-raising campaigns to reduce/eliminate open burning of EEE/WEEE and ELV polymer scrap by the informal sector | Development of awareness-raising materials<br><br>Awareness-raising workshops and dissemination of information (number of stakeholders reached) | 5 years | CM<br>NIMOS<br>OWTC<br>FIN/Customs<br>LB<br>Police<br><br>Private sector |
| Building knowledge and capacity for management of POP-BFR-impacted materials and waste categories within the life cycle management of hazardous substances in EEE, vehicles, buildings, furniture, textiles | Carry out policy and regulatory needs-assessment and develop recommendations.<br><br>Capacity-building of authorities and institution for developing the regulatory framework for life cycle management of EEE, ELVs, construction sector and others<br><br>Capacity building for implementation of the regulatory frameworks for managing WEEE, ELVs and other impacted wastes<br><br>Develop procedures on inspections and maintenance of stockpiles and waste of plastic and other polymers in EEE.<br><br>Training/education of customs authorities on control of import of WEEE, ELVs and other potentially-impacted products. | Policy and regulatory needs-assessment (report)<br><br>Training materials developed<br><br>Procedures on inspections and maintenance of stockpiles and waste developed. | 3 years | CM<br>NIMOS<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br><br>Private sector |
| | Development of education and training materials for life cycle management of POP-BFRs and other hazardous substances (considering already available materials) in EEE, vehicles, buildings, furniture, textiles for relevant sectors<br><br>Capacity-building of life cycle management for POP-BFRs and training of recyclers and waste management sector for relevant sectors within the life cycle management of hazardous substances in EEE, vehicles, buildings, furniture, textiles. | Education and training materials for life cycle management of POP-BFRs<br><br>Capacity-building and training activities conducted (number of workshops) | | |

| Objectives | Activities/tasks | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Establishing monitoring of POP-BFRs and pollutants in the technosphere and other priority areas | Assessment of options for monitoring of POP-BFRs (own/regional capacity or international collaboration<br>Establishment of monitoring approach for POP-BFRs.<br>Monitoring of major product categories and wastes/recycling.<br>Improvement of inventory by monitoring approach where knowledge gaps have been identified. Monitoring of humans, biota and environment for POP-BFR for effectiveness-evaluation and in priority areas (e.g. contaminated site). | Monitoring of POP-BFRs and pollutants in the technosphere and other priority areas (report) | 5 years | Regional and international stakeholders |
| The action plan for POP-BFR (PBDE and HBCD) contaminated sites is integrated in the general action plan on POPs-contaminated sites in Section in 3.3.11. | | | | |

### 3.3.6. *Activity: Import and export, use, stockpiles export, use and wastes of DDT (Annex B Chemicals) if used in the country)*

DDT was used extensively in Suriname in the past for public health purposes. In 1999, the import of DDT chemicals was prohibited under the RC. DDT is prohibited based on the 1999 regulation of HI, and the 2005 ban on pesticides by LVV. Since the use was prohibited, no export, registration, and control of DDT have been recorded. The current inventory review revealed one buried DDT stockpile, which is considered in the action plan. There are no other POP pesticide storage sites known.

*Table 23. Action plan Import and export, use, stockpiles and wastes of DDT (Annex B chemical)*

| Objectives | Activities | Performance indicators | Time Frame | Implementers |
|---|---|---|---|---|
| Further assessing and controlling illegal imports of pesticides including DDT | Further assessment of illegal import activities including counterfeit pesticides<br>Training of customs to control imports of illegal pesticides | Report on the import<br><br>Training on illegal pesticide import included in general training for customs | 3 years | LVV/Port Health Inspectors<br>VG/BOG<br>HI&T<br>FIN/Customs<br>Police |
| Manage buried DDT stockpile | Excavation of stockpile in ESM<br>Export of stockpile for destruction | Stockpile removed and exported for ESM | 6 years | LVV<br>VG/BOG<br>NCCR |
| DDT exposure Assessment | Analyse individual human milk sample (already collected)<br>Investigate exposure sources<br>Investigation and possible Monitoring of environmental exposure sources, such as food (dairy products, fish, meat, eggs a.o.) Integrate with UPOPs monitoring activities | Samples analysed | 2 years | VG/BOG |

### 3.3.7. *Activity: Import and export, use, stockpiles, and wastes of PFOS, its salts and PFOSF (Annex B, Part III chemicals)*

According to the inventory report, PFOS and related substances are not manufactured in Suriname. However, PFOS and related substances enter Suriname in consumer products and articles.

The major stocks of PFOS in Suriname are firefighting foams, which have been used in the past with generation of potentially contaminated sites and ground water. PFOS related substances (sulfluramid) have been used as an insecticide against ants in Suriname since 2006. The import was continued until 2014, but sulfluramid use as an insecticide is now prohibited. There are likely some stocks on private consumer level and at companies. Also, PFOS was and is still used in oil-drilling operations. Suriname has oil-drilling activities, and it could possibly be used in this process. In Suriname, synthetic carpets (tufted carpets) are widely used and most probably contain PFOS-related substances.

Currently there is no monitoring capacity in Suriname to assess contaminated sites or potentially PFOS-containing products. The main issues to be considered in the action plan are contaminated sites and ground water. Also, the identification, management, safe handling and treatment of waste potentially containing PFOS is for Suriname (enforcement authorities, waste management and recycling industry) a problem to be addressed.

PFOS and related substances have been substituted mainly by other per- and polyfluorinated substances (PFAS). PFAS is an issue of concern under SAICM. To promote the synergy of the SC and SAICM, the action plan is extended to other PFAS where appropriate.

*Table 24. Action plan for measures to reduce or eliminate PFOS and control PFAS (SAICM Synergy) including timelines, responsible authorities and stakeholders, and associated cost*

| Objectives | Activities/tasks | Performance indicator | Time frame | Implementer |
|---|---|---|---|---|
| Establishing policy and regulatory framework for management of PFOS and related substances and other PFAS (SAICM synergy) | Assessment of regulatory frameworks of other countries for controlling PFOS and related substances and other PFAS. | Assessment report and draft regulation | 5 years | CM<br>NIMOS<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br>ADEKUS<br>Private sector |
| | Amending existing laws, or develop new laws related to the control and management of PFOS and other PFAS.<br>Banning of PFOS. | Law and policy in place | 3 years | |
| | Custom control and improvement of the traceability of PFOS and other PFAS in imports (including chemicals in products). | Customs trained | 3 years | |
| | Implementation of extended producer/user responsibility for management of PFOS and other PFAS-containing products throughout product life cycle (including disposal). | EPR in place<br>- Industrial use (Firefighting foam and others): EPS ensuring takeback and safe destruction of unused stocks<br>- Consumer products (e.g. carpets, textiles): EPS ensuring take back of end-of-life products and ESM. | 3 years | |

| Objectives | Activities/tasks | Performance indicator | Time frame | Implementer |
|---|---|---|---|---|
| Updating and refining inventory of PFOS and other PFAS (SAICM synergy) use and containing articles and wastes and developed/ updated databases for information management | Refining inventory of PFOS and other PFAS in firefighting foams<br>Refining of inventory of PFOS and other PFAS in consumer and other products<br>Refining of inventory of stocks and waste of PFOS and other PFAS (including landfills)<br>Refining inventory of historic use and release of PFOS and PFAS (see contaminated site action plan) | Updated inventory with robust data and list of data gaps | 5 years | CM<br>NIMOS<br>ADEKUS |
| Life cycle management of PFOS/PFAS-containing products, stockpiles and waste. | Compilation of information of management situation of PFOS and PFAS-containing products in the country | Report | 5 years | CM<br>NIMOS<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br>Firefighters<br>Private sector |
| | Assessment of management and destruction option of PFOS and other PFAS-containing stocks and wastes | Management and destruction options assessed (report) | | |
| | Policy and strategy for control and management of PFOS and other PFAS-containing products and wastes | Strategy incorporated in National Chemical and Waste Management Plan | | |
| | Environmentally safe storage of PFOS-containing materials | PFOS-containing waste stored | | |
| | ESM of PFAS-containing products; destruction or export of PFOS-containing waste considering Basel synergy and extended producer responsibility; | PFOS stocks and waste disposed; Compliance and enforcement of the SC | | |
| Assessing PFOS alternatives in use/exempted uses and substituting PFOS by the most sustainable chemical and non-chemical solution | Compilation of information on alternatives to PFOS and related substances (considering available information of e.g. POPRC) | Information materials developed (report) and disseminated. | 5 years | ADEKUS<br>NIMOS<br>Private sector |
| | Education and capacity-building on alternatives and alternative assessment | Alternatives assessment guidance document | | |
| | Selection of the most sustainable alternative chemicals and non-chemical solutions in the different applications | Phase-in and use of alternatives | | |
| Training and awareness-raising for stakeholder groups on PFOS and other PFAS and establishing approach for information exchange | Development of related education and awareness materials for stakeholder groups (considering already available materials) | Education material selected/modified | 3 years | ADEKUS<br>NIMOS<br>Media outlet<br>Industrial stakeholders |
| | Inform and educate stakeholders including users (e.g. Fire Brigade; paper/leather/furniture/aviation industry), policy makers and public on the environmental and health impact, environmentally-sound management and on alternatives of PFOS and related substances. | Number of workshops/seminar (number participants) | | |
| | Training/education of customs and other authorities on PFOS (and other POPs and other hazardous substances) in products. | Number of trained personnel | | |

| Objectives | Activities/tasks | Performance indicator | Time frame | Implementer |
|---|---|---|---|---|
| Establishing monitoring of PFOS and other PFAS in priority areas | Assessment of options for monitoring of PFOS and PFAS (international collaboration or development of own capacity) | Monitoring approach for PFOS and related substances has been established. | 2 years | CM<br>NH/SWM<br>NH/DWV<br>VG<br>LHB<br>ADEKUS International partner |
| | Monitoring of major drinking water supplies and related food<br>Monitoring biota and soil samples for PFOS especially in vicinity of suspected contaminated sites (contaminated site action plan).<br>Improvement of inventory by monitoring approach where knowledge gaps exist.<br>Monitoring of chemicals and chemicals in products/articles suspected to contain PFOS and its related substances. | PFOS/PFAS data on priority areas such as major drinking water reservoirs | | |
| The action plan for PFOS and related substances-contaminated sites is integrated in the general action plan on POPs-contaminated sites in Section in 3.3.11. | | | | |

### *3.3.8. Activity: Register for specific exemptions and the continuing need for exemptions (Article 4)*

Article 4 of the SC requires the establishment of POPs register for the purpose of identifying parties that have specific exemptions listed in Annex A or B. All registrations of specific exemptions are subject to periodic review.

The listed POPs with specific exemptions and acceptable purposes have increased and meanwhile 9 POPs have been listed with exemptions (HBCD, DecaBDE, SCCPs, PFOS, DDT, Lindane, PCP and recycling of PBDEs). To decide if an exemption is needed an informed decision needs to be made considering alternative chemicals and non-chemical solutions. The appropriate technical/research institutions and committees would make such an assessment. If after such a scientific assessment an exemption is needed, then the Secretariat of the SC/ COP would be informed, and the exemption registered. Therefore, in this action plan an activity is included to establish an appropriate systematic methodology if an exemption is needed to appropriately meet the obligations under Article 4 in future.

*Table 25. Action Plan: Register for specific exemptions and continuing need for exemptions (Art. 4)*

| Objectives | Activities | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| To establish an informed registration process for needed exemptions | Organise stakeholder consultation to establish criteria for assessment and selection of exemptions for chemicals listed under Annex A or B | Stakeholder consultation held and outcomes documented | 3 years | CM<br>NIMOS |
| | Assess if exemptions are needed for HBCD, DecaBDE, or SCCPs and future listed PFOA,<br>Assess if Lindane as second-line treatment can be banned. | Country assessment of current listed POPs with exemptions (report) | | |

| Objectives | Activities | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Listing of POPs where exemptions and periodic review of the need | Inform Secretariat of the SC/ COP on the exemption needed after thorough assessment of the need and the alternative options | Notification submitted and exemption listed | As need arise | CM<br>Affected stakeholders |
| | Periodic review to assess the need for continued exemptions and alternatives and stop exemption and use more sustainable alternatives as soon as feasible | Review report | | |

### 3.3.9. Activity: Measures to reduce releases of unintentional POPs (Article 5)

Based on the assessment of data from the reference year 2015, the estimate of total annual PCDD/F release is c. 77.7 g TEQ for 2015. The major emissions of PCDD/Fs into the environment of Suriname (for 2015) come from combustion processes (46.5 g TEQ/year; 59%) with major contribution from open burning (42.1 g TEQ/year; 54% of total release). Major source is waste burning on landfills/dumps (38.3 g TEQ/year) and further release from private waste burning (3.47 g TEQ/year).

The second largest source was the use of 2,4-D and derivatives (29.0 g TEQ/year corresponding to 37.2% of total emission for 2015. Furthermore, some point sources contribute to UPOPs releases (medical waste incinerators; 3.2 g TEQ/year), an iron smelter (0.04 g TEQ/year), crematoria (0.04 g TEQ/year) and chlorine production (0.02 g TEQ/year).

Activities are proposed for the action plan to reduce the release from unintentionally produced POPs (PCDD/Fs, PCBs, PeCB and HCB). In the action plan the activities were set considering the listing of the priority sources in Annex C of the SC, the total amount of contemporary releases as an outcome of the inventory process and considering point sources with potential risk to humans.

**Waste Management.** Addressing open burning and improvement of waste management will have the largest effect on the reduction of dioxin/UPOPs release but also other related releases like particulate matter (PM), PAHs and black carbon. Therefore, improved waste management is of crucial importance to avoid threats posed to the nation's air and soil integrity. Sustainable industrial development is only possible in the long run if there is proper developed waste management and related recycling and recovery schemes. The 3R[131] approach, emphasises that the principles of "Reduce, Reuse, and Recycle" are the preferable options in the waste management hierarchy.

Suriname has drafted legislation concerning regulations for the safe disposal of waste (Afvalstoffenwet)". This Act categorises the different waste streams, namely, household, farming and gardening, company and industrial waste, hazardous waste, effluent, dredging, and car wrecks. Whether the draft should be updated is something that must be addressed.

The key base for the establishment of an efficient and effective waste management in Suriname is to develop a system which defines in detail the different waste categories present in the country (including all industrial waste, household waste, and others), establish a database of the waste, and clarify appropriate management of the wastes. Therefore, it is recommended to establish a methodology to comprehensively categorise hazardous wastes and other wastes.

A waste management system needs a comprehensive framework including:

- Legal framework for waste management (Hazardous waste and non-hazardous waste)
- Classification of waste, using a well-defined waste catalogue

[131] UNEP Strategic Elements in implementing the 3R Platform http://www.unep.or.jp/ietc/spc/3R_Strategic_Elements.pdf

- Database of waste generated in the country
- Collection, transport, and storage of waste
- Permission, monitoring, and controlling systems for wastes (especially for hazardous wastes)
- Infrastructure of waste treatment including destruction capacity, or a detailed policy for the export of waste which should not be deposited
- Waste management plans
- Awareness-raising of all stakeholders

**BAT/BEP (Best Available Technique and Best Environmental Practice).** Only a few facilities in Suriname, were identified as potential PCDD/F point-sources; medical waste incinerators (3.2 g TEQ/year), an iron-smelter (induction furnace with metal scrap), crematoria (0.06 g TEQ/year) and chlorine-production (0.02 g TEQ/year).

The technology level of the thermal sources of PCDD/Fs is not compliant to BAT/BEP, with possible exposure of operating staff and the surroundings BAT/BEP with respect to PCDD/F control and reduction, is described in the "Guidelines on BAT and provisional guidance on BEP", developed within the SC [132]. Comprehensive BAT Reference documents (BREFs)[133] for large-scale industries have been developed by the EU within and as a base to the Integrated Pollution Prevention and Control process of the EU. These documents could be used in Environmental Impact Assessment (EIA) and permit procedures.

The substitution of Polyvinyl chloride (PVC) by non-halogenated alternatives considers the substitution principle of Article 5C of the Convention and reduces UPOPs releases from medical waste incinerators. The reduction of PVC additionally brings the benefit of reduced use of phthalate and other hazardous additives and exposure to individuals.[134] Efforts can also be combined with reduction of mercury use in hospitals as synergy to the Minamata Convention on mercury.[135] For medical waste incineration non-incineration technologies are available.

**Synergies inventory-making.** Suriname is establishing inventories for different pollutant release (UPOPs, Greenhouse Gases, mercury). It should be assessed where efforts could be harmonised, and if they could be addressed within a common database or approach, such as e.g. Pollution Release Transfer Register.[136]

*Table 26. Action plan for reduction and elimination of PCDD/F and other UPOPs*

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| Established policy and legal framework for reduction and minimisation of unintentional POPs | Undertake law and policy assessment on PCDD/F/UPOPs and relevant co-pollutants.<br>Amend existing laws, or develop new laws where needed, related to the management of UPOPs within an integrated pollution-prevention and control approach. | Policy and legal framework for reduction and minimisation of UPOPs and other pollution-release established | 5 years | CM, NIMOS, FIN/Customs, VG, HI&T, OWTC, NCCR, LB, Police, Fire Brigade, Private sector |
| Regular updating sources | Regularly update of the UPOP inventory and reporting as appropriate | Dioxin/UPOP inventory refined/updated | 4 years | ADEKUS /Task team |

[132] Stockholm Convention (2009) "Guidelines on best available techniques and provisional guidance on best environmental practices" http://chm.pops.int/Programmes/BAT/BEP/Guidelines/tabid/187/language/en-US/Default.aspx

[133] BAT Reference (BREF) documents download page: http://eippcb.jrc.es/reference/

[134] http://www.env-health.org/IMG/pdf/PVC_in_hospitals.pdf; http://www.accessmedicalsupply.com/content/preventing_harm_from_noharm.org/europe/issues/toxins/pvc_phthalates_avoiding_pvc_in_hospitals.pdf./alternatives.php

[135] http://www.gefmedwaste.org/

[136] PRTR; http://www.unitar.org/cwm/prtr/).

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| inventories for PCDD/F and possibly other listed UPOPs with data management and harmonisation with related release inventories. | Quantify other co-pollutants (e.g. PAHs; black carbon) | Other co-pollutants (e.g. PAHs; black carbon) quantified | | NIMOS |
| | Development of a mechanism ensuring appropriate storage and management of data<br>Development of an integrated database of pollutant releases (e.g. Dioxin/UPOPs, GHG; mercury, particulate matter, black carbon) | Database of pollutant releases developed | 2 years | CM<br>NIMOS |
| | Assessment and possibly development of a Pollutants Releases and Transfer Register (PRTR)[137] | PRTR approach assessed (report)<br>Decision on the use or not use | 3 years | |
| **Improvement of Waste Management (harmonisation with national WM plan)** | | | | |
| Improvement of waste management (WM) for reducing UPOPs and other releases from open burning of wastes (private burning & landfill fires) and biomass. | Regulatory framework for waste hierarchy<br>Regulatory frameworks /standards & enforcement to control of open burning | Approval of waste legislation by Council of Ministers<br>Legislation published | 5 years | CM<br>OWTC, NIMOS<br>SSB, NGOs<br>Private sector |
| | Development of waste categories, waste inventory and related management options<br>Material and substance flow analysis of waste/resources | Waste categories defined and inventory<br>MFA for selected waste fractions | 5 years | CM<br>NIMOS, OWTC<br>Private Sector<br>NGOs, ADEKUS |
| | Implementation of sound management of waste with increased reuse, recycling and recovery | Recycling rates increased | 10 years | CM<br>OWTC/VOV<br>RO<br>Private sector<br>NGOs |
| | Closure of dumpsites and stop illegal dumping of wastes (fines).<br>Construction engineered landfills for remaining waste disposal | Dump sites closed<br>Sanitary landfill(s) developed | Ongoing<br>10 years | CM<br>OWTC/VOV<br>RO |
| | Develop an awareness for landfill operators on the impacts of open waste burning and implement education program for control<br>Awareness-raising program and fines for open waste burning on private level | Trainings for enforcement officer landfill operators and public conducted<br>Waste burning reduced (75%) | 2 years | CM<br>NIMOS, NGOs<br>OWTC/VOV<br>RO/<br>Fire Brigade<br>General Public |
| Establish costing system for waste generation and management (deposition fees; export fees) | To establish appropriate fees which cover costs of waste management including aftercare of landfill, development of sanitary landfill | Fees and taxes established | 3 years | CM<br>FIN, RO<br>OWTC, NGOs<br>Private sector |

[137] PRTR; http://www.unitar.org/cwm/prtr/.

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| Upgrading the informal sector working in the field of waste collection, management and low-tech recycling | Integrating people working in the informal waste/recycling sector into normal occupation.<br><br>Train workers in the waste management and recycling sector | Number of people from informal sector trained and integrated | 3 years | CM<br>RO<br>OWTC<br>Private sector<br>NGOs |
| **Implementation of Best Available Technology and Best Environmental Practice** | | | | |
| Policy framework for BAT/BEP for priority emission sources | Develop Policy and possibly legislative base for BAT/BEP requirements for facilities listed in Annex II and III. | Permits based on BAT/BEP | 5 years | CM<br>NIMOS, SSB<br>Private Sector<br>VG, NH, OWTC |
| Adoption of BAT/BEP and Integrated Pollution Prevention and Control (IPPC) for the iron smelter | Assessment of BAT/BEP options for UPOPs and other pollutant (mercury, PM, GHG) reduction<br><br>Implementation of BEP and possibly BAT. | BEP measures introduced | 3 years | CM<br>NIMOS, NH<br>OGS, HI&T, SSB<br>Private sector |
| Reduction and minimising UPOPs releases from medical waste incinerators | Education of operators and competent authorities on minimising Dioxin/UPOPs release and emission-control<br><br>Implementation of regulatory framework including BEP and/or BAT for meeting regulation limits<br><br>Selection and implementation of sound treatment of medical waste including also non-incineration technologies (WHO guideline)<br><br>Strengthen institution and human resource capabilities to implement environmentally-sound medical waste management | UPOPs releases from waste incinerators minimized<br><br>Medical waste management improved<br><br>Non-incineration technology assessed and possibly used<br><br>Institutions and staff trained | 5 years | VG<br>Hospitals<br>NGO<br>Private sector<br>NIMOS<br>RO<br>RGB |
| BAT/BEP for chlorine production | Assessment of chlorine production technology | Technology assessed and BEP applied | 5 years | NIMOS<br>Private sector |
| Reduce UPOPs by substitution of chemicals and materials responsible for release | Assess BAT limits and international regulations<br><br>Develop standards for chemicals and consumer products so that products that contain POPs and may produce UPOPs are restricted. | Regulatory limits assessed and included in regulation<br><br>BAT-limit for PCDD/F and other UPOPs in pesticides and other chemicals are set | 3 years | CM<br>LVV<br>NIMOS<br>Private sector<br>VG<br>LB |
| | Identify the use of chemicals associated with the chlorine cycle considering the Toolkit guidance [138] and evaluate their release of | List developed | 5 years | |

[138] UNEP Toolkit Annex 2 Guidance on Identifying Sources of PCDD/Fs. http://toolkit.pops.int/Publish/Annexes/A_02_Annex02.html

| Objectives | Activities | Performance indicators | Time frame | Implementer |
|---|---|---|---|---|
| | UPOPs (e.g. PVC production/use, chlorine in industries and water treatment, pesticides/pigments containing UPOPs or resulting in UPOPs potential release). | | | |
| | Monitoring of 2,4-D and other suspected chemicals | Monitoring data (possibly bio-assay) | 3 years | CM<br>LVV<br>ADEKUS<br>Int. Cooperation |
| | Identify and promote feasible and affordable alternatives to chemicals and materials contributing to UPOPs release. | Listing developed and published | 3 years | CM, LVV, NIMOS, Private sector, VG, LB |
| **Awareness raising, education and monitoring of UPOPs** | | | | |
| Awareness-raising and education | Development of education (on all levels) and awareness materials on the health and environmental impact of Dioxins and other UPOPs<br>Educate the public and other stakeholders on the environmental and health impact of UPOPs<br>Awareness-raising campaigns on Dioxins and UPOPs and other pollutants of concern for relevant stakeholders and sources (open burning, industrial sources, industries, waste wood). | Awareness-raising conducted and network established | Continues | VG/BOG<br>NIMOS<br>ADEKUS<br>LVV/Extension Workers<br>OWC |
| Establishing monitoring of PCDD/F and other UPOPs and relevant pollutants from Annex C, Parts II and III sources and human exposure | Assessment of the need and the options for monitoring Dioxins and other UPOPs from priority sources and for human exposure (food, feed, soils).<br>Establish and strengthen the national capacity for UPOPs-monitoring considering instrumental analysis, bio-assay and international co-operations.<br>Emission monitoring of Annex C, Parts II and III priority sources releasing PCDD/F and other UPOPs.<br>Monitor priority environmental and foods samples for Dioxins UPOPs (e.g. samples with potential human exposure for residents around suspected contaminated sites).<br>Monitoring of chemicals and chemicals in products/articles known to potentially contain PCDD/F and other UPOPs. | Monitoring of PCDD/F and other UPOPs and relevant pollutants from Annex C, Parts II and III sources and human exposure established | 3 years | CM<br>ADEKUS<br>VG/BOG<br>International partner |
| The action plan for Dioxin/UPOPs contaminated sites is integrated in the general action plan on POPs-contaminated sites in Section in 3.3.11 | | | | |

### 3.3.10. *Activity: Identification and management of stockpiles, waste and articles in use, including release reduction and appropriate measures for handling and disposal (Article 6)*

Toxic releases from stockpiles and waste constitute serious threat to human health and the environment. This calls for their safe, efficient and environmentally-sound management. Activities geared towards the development of appropriate strategies and measures to stem releases through actions such as proper handling, collection and transport and disposal of such stockpiles and waste are outlined below and in the action plans for the individual POPs above.

In addition to the remaining PCB and pesticides, large volumes of POP-BFR-containing wastes and stocks have been generated (WEEE plastic; plastic/polymers of end-of-life vehicles; insulation foam from construction). A similar situation exists with PFOS and related substances (PFOS precursors) and related containing stockpile (carpets and possibly others). Currently perfluorooctanoic acid (PFOA) and perfluorohexanesulfonic acid (PFHxS) are evaluated by POPRC as POPs and SAICM have all perfluorinated alkylated substances as an issue of concern and related wastes (treated synthetic carpets, impregnated paper, textiles and furniture) will need to be managed and possibly destroyed in future.

Furthermore, SCCPs have been listed in 2017, which is still used at volumes of 65,000 tonnes per year in a wide range of applications (e.g. lubricants, metal working fluids, PVC, rubber, textiles). By this current and past use, new POPs stockpiles are/were generated which will need to be managed in future.

Wastes containing these POPs and PBT chemicals need to be managed. Activities for the management of POPs-specific waste are listed in the individual action plans and would be considered/linked to the activities listed in this generic action plan for POPs stockpiles.

The overall goal is to develop and implement a programme to manage the stockpiles/wastes and reduce releases from stockpiles and waste in accordance with internationally-accepted guidelines and practices for handling, storage, transportation, and disposal thereof.

The NCCR, under DEF, is the coordinating body whenever a disaster occurs and spilled chemicals need to be reclaimed, transported, and stored. The NCCR mainly contracts one private specialised company to assist whenever hazardous waste must be removed. The storage capacity for chemical and hazardous waste that cannot be disposed of in an environmentally-sound way is very limited in Suriname. Extra storage capacity for these chemicals and hazardous waste must be provided.

A temporary storage facility - an Intermediate Collection Centre (ICC) should be established. The ICC should be in conformity with the international ICC standards as presented by e.g. the FAO.

Certain disposal practices identified during the inventory process, such as dumping of wastes, open burning of assorted waste, burying waste, and inadequate storage of POPs are responsible for the generation and release of POPs and UPOPs, and associated soil contamination. For PFOS-containing materials, groundwater can also become contaminated. It is important that appropriate infrastructure and capacity is developed and established for POPs and waste management.

**POPs-pesticides stockpiles**

An almost countrywide inventory for obsolete and POPs-pesticides stockpiles and waste has been carried out during the development of the first NIP. A few storage sites might still be missing in the inventory. Mostof the inventory data is uploaded in the FAO PSMS, and therefore recorded for future use - such as the designing of specific site clean-up programs. The inventory of remaining stockpiles must be carried out and the data should also be uploaded in the PSMS before a complete, countrywide clean-up campaign can be designed.

**POPs pesticides of articles in use and waste**

No inventory has been established on POPs-pesticides in articles in use and wastes. However, articles in use and wastes with POPs pesticides are most probably present in Suriname. For example, PCP is applied in the glue to prevent woodworms from affecting the plywood. POPs-pesticides-related material such as empty packaging and articles in use containing POPs pesticides are being disposed of and end-up in landfills of Suriname. Figure 4 shows a picture of pesticide related waste on the domestic waste landfill in Wageningen.

The need to develop a strategy for the assessment of POPs-pesticides, articles in use, and waste should be assessed. The recent implementation of the empty-container programme will prevent more of Suriname's future contamination of soil and groundwater.

*Photo by B. Fokke, 2011*

*Figure 4. Empty pesticide containers on the domestic waste landfill/dump represent a risk for human exposure and environmental contamination*

**Capacity-building handling hazardous waste and POPs pesticides**

The NCCR has a small Hazmat team. More capacity is required for disaster control. Thus, the NCCR currently makes use of contractors. In the event of major disasters, the main task of NCCR is the coordination and control of the disaster. In 2009, NCCR received HAZMAT training. It utilises the hazardous material (HAZMAT) classification system for handling hazardous waste. This training needs to be updated and given to more personnel.

The classes are:

- HAZMAT C: Personnel with regular safety training and experiences on the handling of non-hazardous materials.
- HAZMAT B: Personnel with regular safety training and experiences on the handling of non-hazardous materials. This group can read and use MSDS and other safety sheets. They are also allowed to work with hazardous waste and have the capacity to manage a clean-up campaign.
- HAZMAT A: Personnel with regular safety training and experiences on the handling of non-hazardous materials. This group can read and use MSDS and other safety sheets. They are also allowed to work with hazardous waste and have the capacity to manage clean-up campaigns. They closely cooperate with the Fire Brigade and Police, and they are also trained paramedics.
- A HAZMAT engineer has the qualifications of HAZMAT and can design action plans for clean-up campaigns for hazardous chemicals. On the other hand, an engineer has a solid chemical background.

Safe, efficient and environmentally-sound management of stockpiles as well as proper handling and disposal of articles in use, which contain POPs, and other hazardous chemicals are important for the achievement of the country obligations under the SC (Article 6) and SAICM. Stockpiles and wastes containing perfluorinated alkylated substances (SAICM issue of concern) or hazardous chemicals in electronics (SAICM emerging policy issue) need to be managed so that these and other hazardous chemicals do not enter the environment and impact human health and the environment including wildlife. To achieve such goals appropriate end-of-life management of impacted waste is important.

At the same time, only a part of these waste categories are impacted. The waste contains valuable resources to be recovered considering the need to recycle. Therefore, an appropriate approach on material recovery, energy recovery and destruction of pollutants need to be developed. The synergies with BC and other related activities need to be considered within these strategies/approaches.

**It should be noted that:** the management of the stockpiles of the individual POPs (PCBs, pesticides, PFOS, POP-PBDEs, HBCD) is included in the action plans of individual POPs above.

*Table 27. Action plan to reduce releases from stockpiles and wastes (Article 6)*

| Objectives | Activities | Indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Please note: The management of the stockpiles of the individual POPs (PCBs, pesticides, PFOS, POP-PBDEs, HBCD) is included in the action plans of individual POPs above | | | | |
| Identification of options and limitations for the destruction and management of POPs and hazardous chemicals in the country and the current and future capacity needs and options | Evaluation of the option and limitation of destruction-capacity of waste (chemicals and chemicals in products) in the country and the region<br><br>Evaluation of the option and limitation of other ESM measures for POPs-containing wastes and chemicals and chemicals in products (CiP) in the country and region<br><br>Needs assessment for improvement of management and destruction capacity | Documentation on destruction-capacity<br><br>Documentation of other ESM options in the country and region<br><br>Need assessment report | 3 years | CM<br>LVV<br>NIMOS<br>FIN/Customs<br>VG, HI&T<br>OWTC<br>NCCR<br>LB<br>Police<br><br>BCRC Caribbean<br>Private sector |
| Developing measures for safe handling, separation and sound disposal of stockpiles of chemical and articles in use and appropriately recovering resources and energy. | Develop manuals for safe handling and disposal.<br>Develop guidelines for the transport of POPs wastes<br><br>Establish collection scheme for POPs-containing articles.<br><br>Establish appropriate separation, recycling and energy recovery schemes for POPs-containing waste. | Manuals for safe handling and disposal<br>Guidelines on transport<br><br>Collections scheme for POPs-containing products and wastes.<br><br>Separation schemes for waste fractions like e-waste, end-of-life vehicles, waste wood or waste oils | 10 Years | CM<br>LVV<br>NIMOS<br>FIN/Customs<br>VG<br>HI&T<br>OWTC<br>NCCR, LB<br>Police<br>Private sector |
| Store POPs stockpiles and hazardous chemical and wastes in a safe and environmentally-sound manner | Identify appropriate storage facilities for interim storage of stockpiles<br><br>Upgrade existing information for safe management of stockpiles | Guidelines for safe storage<br><br>Selected storages for stockpiles/wastes<br><br>Workshops to train personnel in management of stockpiles | 3 years | CM<br>NIMOS<br>LVV<br>OWTC<br>NCCR |

| Objectives | Activities | Indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Destruction, disposal or export of POPs wastes and other hazardous chemicals and waste in an ESM | Destruction of POPs-containing waste and other hazardous chemicals-containing waste in an ESM<br><br>Possible disposal of selected POPs-containing waste fraction with low leaching risk<br><br>Export of POPs and other hazardous chemical waste which cannot be treated or disposed in the country | POPs and other hazardous chemical waste (including hazardous chemicals in products) managed in ESM | 5 years | CM<br>LVV<br>FIN/Customs<br><br>BCRC Caribbean |

### *3.3.11. Activity: Identification of contaminated sites (Annex A, B, and C Chemicals) and, where feasible, remediation in an environmentally-sound manner*

**General**

To date, there is no intergovernmental policy instrument that addresses the identification and remediation of contaminated sites. SC Parties must however endeavour to develop strategies for identifying sites contaminated with POPs (Article 6 SC). While not explicitly requiring remediation of contaminated sites, the SC stipulates that any remediation attempts must be carried out in an environmentally-sound manner (Article 6 SC).

The activities for the identification and assessment of POPs-contaminated sites should be harmonised with the general strategy of Suriname to assess and remediate contaminated sites and hotspots. Considering the outcome of the inventories, Suriname probably has contaminated soil and groundwater. Like other countries, the country faces a challenge to implement a cost-effective and sustainable contaminated land management plan. However, it can use the lessons learned e.g. in the USA and Europe on contaminated land management. Within the Stockholm Convention BAT/BEP and unintentional POPs Toolkit expert group, a working group on POPs contaminated sites has been established where information on POPs contaminated sites are generated to support SC Parties. Suriname has started addressing contaminated sites within the FAO project on pesticide-contaminated sites.

Initial institutional and individual capacities in land management are being developed through the Land Registration and Information System (GLIS) project from the Ministry of Spatial Planning, Land and Forest Management (RGB). The GLIS project focuses on the modernisation of the national land cadastre and property registry system. GLIS produces high-resolution digital satellite maps of the country and build capacity for their use within RGB. The latter, together with Conservation International Suriname and SARVISION, produced an up-to-date vegetation map for Suriname for the year 2010. This project provided hands-on training to local governmental institutions in the use of advanced remote radar-sensing technology for land and vegetation cover mapping, classification, and monitoring. This map can also be used as the basis for the detailed mapping of waste stockpiles, contamination sites, as well as waste streams. LVV make use of ARCVIEW and GPS to produce maps. The individual POPs inventories have shown that all POPs groups have resulted or have likely resulted in some contaminated land. The details are compiled previously in Section 2.3.8.

**Soil survey strategy suspected sites**

The approach for the soil survey aims at reducing risks related to direct exposure to pure product and contaminated topsoil at the site (hotspots). Repackaging and removal of the pure product prevents direct exposure to pure product. Direct exposure to contaminated soil that people make contact with can be prevented by remediation.

Remediation can only be carried out safely if the contractor is aware of all aspects of the remedial work. To provide the contractor with an understanding of the soil contamination, a soil survey must be carried out. The findings of the soil survey should be reported. The project commissioner can use the report as a tender document. This report should be part of the contract document and contains information essential for a safe and cost-effective remediation.

A precondition of soil remediation is that the campaign is only focused on remediation of the topsoil that forms an acute risk. Usually, the soil posing an acute risk is the topsoil (0.0-0.5 meters below surface) with a POPs-concentration of 50 mg/kg and more. For PCDD/F problematic exposure levels are for soils where chicken or other food animals at c. 5 ng TEQ/kg, for other agricultural activities best below 10 ng TEQ/kg and for playground or residential area below 100 ng TEQ/kg if no food animals or gardening activities are conducted. The soil survey strategy depends on the type of site. A distinction should be made between a preliminary survey, a topsoil survey, a pit survey, and a tailor-made soil survey. Four storage site categories have been distinguished and discussed during the inventory and workshop held in Paramaribo in March 2011. The proposed categories are presented in Table 28. For each site category, a soil-survey strategy must be established.

*Table 28. Categories of suspect sites*

| Category | Characterization |
|---|---|
| 1. Site with POPs | Site with one or more storage building(s) with obsolete POPs-pesticides that can be repacked, as well as pits with obsolete POPs-pesticides. The known POPs pesticides have been repacked and exported.<br>Other sites with POPs are sites with potentially PCB-containing transformers.<br>Also, sites with piled e-waste plastic containing POP-BFRs. However, the exposure risk to POP-BFRs in plastic is low if they are not burned in the open.<br>so, PFOS-firefighting foams are still in storages. Here the POPs are contained and do t normally leak until used. |
| 2. Site with buried POPs | POPs pesticides sites with one or more storage building(s) as mentioned under category 1. These sites also can have pit(s) with buried obsolete POPs-pesticides.<br>Industrial POPs have been disposed to landfills and dumpsites in the past with potential future relevance.[139] |
| 3. Sites where POPs have been used | There are a range of sites where POPs have been used but it is unclear to what extent these POPs have polluted the area or if the POPs have been degraded over time in the soil or have migrated to the groundwater.<br>For POPs pesticides airstrips might be contaminated to a certain extent.<br>Other sites are areas where PCB transformers have been stored or used with possible release over time.<br>For PFOS a range of sites are known where firefighting practice and use in fires have likely polluted soils and ground water. |

[139] Weber R, Watson A, Forter M, Oliaei F (2011) Persistent Organic Pollutants and Landfills - A Review of Past Experiences and Future Challenges. Waste Management & Research 29 (1) 107-121.

| Category | Characterization |
| --- | --- |
| 4. Unknown site | POPs-pesticides might have been dispersed in the surrounding environment of pesticide storage sites. The obsolete POPs-pesticides cannot be reclaimed and have polluted the topsoil.<br>Also, firefighting foam have been used for trainings and a range of these locations could not be tracked within this first inventory process. PFOS as a pesticide have been used in private areas and many homes.<br>PCB oils might have been used in the past as lubricants or cutting oils or other open applications.<br>Such hotspots are difficult to identify (at least in short term). |

For all sites, a preliminary site assessment is necessary to establish the category of the site and to be able to prepare the most suitable site-specific assessment. The preliminary site assessment consists of interviews with local stakeholders and site users, a site walkover, and the preparation of a photo report. This preliminary site assessment is part of a normal POPs inventory. It is highlighted here because the focus of this part of the inventory should be on the topsoil quality. One of the aims of the preliminary site assessment is to identify suspect locations of contaminated topsoil and other suspected locations because:

- Humans could be in direct contact with topsoil (playing children);
- Wind can blow topsoil away, especially if there is no vegetation cover;
- Vegetation takes most water from the topsoil; and
- Vegetation on contaminated soil could be consumed (indirect exposure).

Furthermore, since PFOS and related substances are the first highly water soluble POPs, also the contamination of ground water and potentially contaminated drinking water needs to be considered as a relevant exposure pathway to POPs[140] in addition to exposure to PFOS contaminated soils.[141] Depending on the pollutant, different securing and remediation technologies might be applied which need to be explored for the individual location and pollutant.

Article 6 of SC requires that Parties develop appropriate strategies for the identification of sites contaminated with chemicals listed in Annex A, B or C and if remediation of such sites is carried out to do it in an environmentally-sound manner. The country strategy is as outlined on the following page.

[140] Hu et al. (2016) Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants. Environ Sci Technol Lett. 3, 344-350.

[141] Brambilla G et al. (2015) Pathways and factors for food safety and food security at PFOS contaminated sites within a problem based learning approach. Chemosphere 129, 192-202.

*Table 29. Action plan for identification of contaminated sites (Annex A, B and C chemicals) and securing and remediation in an environmentally-sound manner*

| Objectives | Activities | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Regulatory framework for contaminated sites established | Develop/update legislation to set criteria for determining contaminated sites for relevant POPs. | Draft regulation developed on contaminated sites and soils. | 5 years | CM, LVV, NIMOS, FIN/Customs, VG, HI&T, OWTC, NCCR, LB, Police, Fire Brigade |
| | Legislation on liability related to contamination and clean-up procedures. (Polluter Pays Principle (PPP) | Draft Legislation on liability for contamination and clean-up (Polluter Pays Principle (PPP)) | 3 years | |
| | Establish guidelines for soil and ground water assessment and limits | Guidelines | 5 years | |
| Methodology to identify, assess and prioritise sites contaminated with Annex A, B and C chemicals | Develop methodology to identify, assess and prioritise POPs contaminated sites considering available guidance documents[142] | General procedures for investigations developed (report) | 3 years | CM<br>NIMOS<br>ADEKUS<br>LVV<br>VG/BOG |
| | Establish methodology for ground water and soil assessment | Methodology (guidance) | 3 years | |
| | Develop list of potentially contaminated sites (see individual POPs below) | List compiled (considering individual POP groups) | 2 years<br>ongoing | |
| | (Preliminary) prioritisation of POPs contaminated site | List of priority sites | 2 years | |
| | To participate in or to follow the UNEP working group on POPs-contaminated sites | Expert nominated for contact/ participation UNEP BAT/BEP group | 1 years | |
| Secure POPs contaminated sites, and where feasible conduct remediation of contaminated sites | Standard procedures for registering and securing contaminated sites | Procedures for securing contaminated sites identified and isolated. | 10 years | CM<br>LVV<br>NCCR<br>JP<br>VG/hospitals<br>RO/DCs<br>Private sector<br>Havenbeheer<br>N.V.EBS |
| | Identify potential remediation technologies available. Develop strategies for the environmentally-sound management of POPs-contaminated sites | Compilation and selection of available environmentally-sound remediation methods (report)<br><br>Draft guidelines on clean-up procedures | | |
| | Train and upgrade skills of personnel in the assessment, securing and remediation of contaminated sites | Training of adequate staff on contaminated sites; contaminated site expert in governmental institution | | |
| Countrywide database for POPs contaminated sites considering relevant co-pollutants | Assessment of database systems for contaminated sites in other countries<br><br>Selection of database approach and establishing POPs contaminated site database considering co-pollutants integrated in a general contaminated site database | Report on database (with recommendation)<br><br>Database selected and established | 5 years | CM<br>NIMOS<br>LVV |

[142] See e.g. UNIDO POPs contaminated site Toolkit http://chm.pops.int/Implementation/BATandBEP/AdditionalResources/tabid/1493/Default.aspx or UNEP Toolkit Category 10 (http://toolkit.pops.int/Publish/Main/II_10_HotSpots.html).

| Objectives | Activities | Performance indicators | Time Frame | Implementer |
| --- | --- | --- | --- | --- |
| Identification and securing and remediation of POPs pesticides contaminated sites | Training HAZMAT team members | Educated HAZMAT teams | 3 years | LVV<br>NCCR<br>OWTC<br>VG |
| | Identification of all (former) POPs pesticides use and storage/disposal locations including former use areas for PCP. | Inventory report of potentially contaminated sites | 3 years | |
| | Identify the level of contamination of soil and ground water and potential receptors and exposure risk | Number of site assessments completed and reported | 5 years | |
| | Obtain for each site a tailor-made site clean-up plan | Number of remediation plans completed and reported | 5 years | |
| | Remediate, contain and monitor, land farms with contaminated soil from hotspots and phytoremediation sites with contaminated soil | Number hotspot contained/land farmed and monitored | | |
| | Develop/update database and conceptual site models of potentially contaminated sites | Database established (one database for all POPs or all contaminated sites) | 4 years | |
| Identification, assessment, securing and possibly remediation of PCB-contaminated sites | Assessing of potentially PCB-contaminated sites (storage, use and disposal PCB equipment)<br><br>Securing of sites and remediation of sites as appropriate | Potential PCB-contaminated sites are assessed, ranked for priority and secured | 5 years | CM<br>N.V.EBS |
| Identification, assessment, securing and possibly remediation of POP-PBDE-contaminated sites.[143] | Develop method for risk assessment of sites where WEEE, ELV or other have been treated<br>Assessment and securing and possible remediation of contaminated sites | Method for risk assessment developed<br><br>Sites secured and remediation measures identified | 5 years | |

[143] At sites where WEEE and end of life vehicle and other PBDE containing waste is treated the final pollution is a mixture of many pollutants (Wong et al. 2007). Wong MH, Wu SC, Deng WJ, Yu XZ, Luo Q, Leung AO, Wong CS, Luksemburg WJ, Wong AS (2007) Export of toxic chemicals - a review of the case of uncontrolled electronic-waste recycling. Environ Pollut. 149(2):131-140.

| Objectives | Activities | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| Identification, assessment, management, of potentially PFOS and PFAS-contaminated sites and securing /remediation needs | Use guidelines for identification and assessment of PFOS/PFAS-contaminated sites<br><br>Database and maps of potentially contaminated sites and prioritisation of the sites (risks) for further assessment and clean-up<br><br>Analytical confirmation of POPs contamination for the identified locations (according to prioritisation list)<br><br>Take measures to secure the contaminated sites to stop human exposure and environmental releases<br><br>Identification of clean-up measures and initiate clean-up procedures considering priority sites. | Guidelines on identification developed<br><br>Workshops conducted, staff trained<br><br>Priority sites determined<br><br>Pollution assessed (data)<br><br>Sites secured and exposure stopped<br><br>Strategies for addressing sites developed | 3 years | CM<br>NH/SWM<br>Fire Brigade<br>NCCR<br>Luchthavenbeheer |
| Assessment, management, database of potentially PCDD/Fs and other UPOPs-contaminated sites and securing /remediation needs | Use guideline[144] for defining, identification and assessment of UPOPs-contaminated sites | Contaminated site criteria defined, and assessment approach documented (report) | 3 years | CM<br>VG/BOG<br>LVV |
| | Training in identification and management of UPOPs contaminated sites | Guidelines on identification developed Workshops conducted, staff trained | 3 years | |
| | Database of potentially contaminated sites and prioritisation of sites<br><br>Analytical confirmation of contamination for identified sites (based on prioritisation)<br><br>Take measures to secure contaminated sites to stop human exposure and releases<br><br>Identification of clean-up measures and initiate clean-up activities considering the prioritisation. | Priority sites determined<br><br>Pollution assessed<br><br>Sites secured<br><br>Priority sites cleaned | 5 years | |

### 3.3.12. *Activity: Facilitating or undertaking information-exchange and stakeholder participation*

This activity is supporting and establishing a system for exchanging information on POPs at national, regional and international scale. Referring to Articles 9 and 10 of the Convention, the Parties provide the access to information to the community and constantly update the information on POPs. The information exchange between the SC Parties is performed via the National Focal Points and with the support of the SC Secretariat.

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[144] See e.g. UNEP Toolkit Category 10 (http://toolkit.pops.int/Publish/Main/II_10_HotSpots.html) or UNIDO POPs contaminated site Toolkit http://chm.pops.int/Implementation/BATandBEP/AdditionalResources/tabid/1493/Default.aspx

As it relates to the content of the information exchange, the Parties to the Convention exchange information on the activities directed to reduce or eliminate POPs and, on the risk, imposed by POPs to humans and environment, including information of involved socio-economic costs.

Information-exchange and stakeholder involvement are activities to be elaborated for the implementation of the NIP. The development of a comprehensive strategic information-exchange and communication plan will be one step to take to achieve successful implementation of the NIP. The communication plan must also ensure that POPs-management issues will be addressed through various media - a website and other means of communication, to raise public awareness and to receive full collaboration. This activity is closely linked with the action plan on awareness-raising in Section 3.3.13 on the following page. A national activity for institutional information-exchange will be developed through regular workshops to ensure full stakeholder engagement.

Due to the complexity of the increasing numbers of POPs and POPs-like chemicals, close information-exchange on the regional and international levels must occur.

*Table 30. Action plan for facilitating information-exchange and stakeholder participation*

| **Objectives** | **Activities** | **Performance indicator** | **Time frame** | **Implementer** |
|---|---|---|---|---|
| Information-exchange on POPs in the region and internationally | Development of a mechanism that information generated in the Stockholm, Basel and Rotterdam Secretariat and SAICM Secretariat reach the country and the stakeholders.<br><br>Mechanism that information on POPs from the country with regional or international relevance are communicated to the regional Basel and/or SC centres and to the BRS secretariat | Information-exchange on POPs in the region and internationally is ensured | 3 years | CM<br><br>Regional stakeholders |
| Access of information and documents for national stakeholders | Establish mechanism and possibly a website that key documents; information and news on POPs and hazardous chemicals can be found by stakeholders.<br><br>Evaluation of the SC documents and decide if any document should be translated into Dutch<br><br>Possibly translate selected documents into Dutch | Key documents and information accessible to stakeholders | 3 years | CM<br>NIMOS |
| Improve information-exchange on national level between stakeholders | Facilitate the dialogue between industry, research and policy makers<br><br>Establish or improve dialogue between science community and policy-makers for improved science-policy dialogue. | Information-exchange on national level between stakeholders take place | 3 years | CM<br>NIMOS<br><br>ADEKUS<br><br>Private sector |

### *3.3.13. Activity: Public/stakeholder awareness, information-awareness and education (Article 10)*

Article 10 of the SC on awareness, information and education, requires parties to promote and facilitate awareness among policy and decision makers regarding POPs. Parties should ensure that all available information on POPs is made available to the public and the information is kept up to date. In pursuance of this article, parties should ensure that appropriate education programmes are put in place for groups such as women, children and the least educated, as well as for workers, scientists, educators and technical and managerial personnel.

The successful implementation of the SC in the country will only be achieved when the relevant stakeholders (policy makers, industry, science community, civil society and general population) are sensitised on the nature of POPs, other hazardous chemicals and their effects on human health and the environment. Appropriate awareness strategies for stakeholders would secure the needed commitment to achieve the objectives of the Convention. It is therefore important for action to be directed at promoting the continuous and detailed awareness, information and training programmes on POPs and hazardous chemicals in products and in the life cycle (SAICM synergy). Information needs to be individually developed and targeted for specific stakeholder groups including policy and decision makers, industry as well as the general public. The individual stakeholders should be trained/informed of their respective roles in implementation of the SC.

The awareness activities will be linked to general awareness activities on chemical safety, awareness programmes on public health, and on green economic development, as well as awareness programmes on sustainable consumption and production - all aimed at broad awareness-raising strategies for sustainable development.

An example of a past awareness activity in Suriname is the production of films, including a documentary on POPs, produced by the former ATM and distributed to all relevant stakeholders. It has been acknowledged that an awareness-raising campaign through appropriate films and accompanying discussions can have excellent results and make a serious input and can be communicated in schools, academia, as well as mass media. A comprehensive approach on using films for awareness on national level has been developed in Switzerland (Films for the Earth)[145]. Here more than 200 films on sustainability and environmental topics including some POPs-related films such as "Story of Stuff"[146] or "Silent Snow"[147] (on contamination of the Arctic by the global use of POPs) have been compiled and are communicated during festivals or via the website (https://filmefuerdieerde.org/en) and video on demand.

A range of suggested awareness activities have been included in the individual action plans of this NIP for pesticides, PCBs, UPOPs, and new industrial POPs (POP-BFRs and PFOS). These activities will be coordinated and addressed collectively where appropriate. In this section general activities on awareness of POPs and hazardous chemicals are compiled.

145 https://filmefuerdieerde.org/en

146 www.storyofstuff.org

147 http://www.silentsnow.org

*Table 31. Action plan for public awareness, information and education activities*

| Objectives | Activities | Performance indicators | Time Frame | Implementer |
|---|---|---|---|---|
| General Awareness on POPs and on POPs-related SAICM issues and general hazardous chemicals as appropriate<br>(For specific awareness activities for individual POPs see the respective action plans of individual POPs and coordinate) | Compile available state of art awareness and education materials on POPs and other hazardous chemicals and GHS | Awareness and education materials on POPs and other hazardous chemicals and GHS compiled | 3 years | NIMOS<br>ADEKUS<br>LVV |
| | Adopt education and training materials on POPs & hazardous chemicals tailor-made for target groups (policy makers, industry, public, curricula) considering available materials and translate selected materials into the country languages | Education and training materials on POPs & hazardous chemicals tailored to target groups | 5 years | |
| | Implement trainings and programs for teachers and lecturers about toxicology, environment and ecology issues related to POPs and hazardous and green/sustainable chemicals | Trainings and workshops conducted (number participants) | 3 years | NIMOS<br>'Health in all policies' stakeholders'<br>ADEKUS<br>School |
| | Providing training and guidance for stakeholder groups that are directly exposed, treating equipment and waste containing POP (see individual POPs action plans) | Training and guidance for stakeholder groups that are directly exposed, treating equipment and waste containing POP (see individual POPs action plans) provided | 3 years | |
| | Implement communication activities, raise awareness on POPs and POP-like chemicals; exchange and dissemination of information on these chemicals in media outlets targeted to stakeholder groups and the public. | Number of communication activities and number of stakeholders reached | Continuously | |
| | Implement the activities to raise awareness and training for inspectors; customs, environmental police, on the contents related to POPs management | Trainings and workshops conducted | 3 years | |
| | Integrating POPs and hazardous chemicals in the environmental education syllabus of basic and secondary schools | Updated syllabus of basic and secondary schools | 3 years | |
| Raising awareness on POPs & alternatives to POPs and introduction of green and sustainable chemistry approach | Compile information materials available on alternatives to POPs and Green and Sustainable Chemistry | Materials compiled (place on POPs website) | 1 year | NIMOS<br><br>Industrial stakeholders |
| | Develop education modules on Green and Sustainable Chemistry versus POPs/POPs-like chemicals for curricula of secondary and tertiary education | Modules for curricula developed and used in secondary and tertiary education | 3 years | |
| | Develop information materials on Green and Sustainable Chemistry for selected industries | Training on alternatives to POPs considering green and sustainable chemistry (numbers; participants) | 5 years | |

### 3.3.14. Activity: Effectiveness evaluation (Article 16)

Article 16 of the Convention requires parties to establish mechanisms for providing comparable monitoring data on the presence of Annex A, B and C chemicals. According to Article 16 (paraphrased): Parties, in accordance with their technical and financial capabilities and using existing monitoring programmes and mechanisms (where possible), are to co-operate on a regional basis, when appropriate, and contribute to a global monitoring programme for the SC. This evaluation shall be conducted based on available scientific, environmental, technical and economic information including national reports. As main matrices selected for assessment of the effectiveness of the implementation, human milk/blood and air and water have been chosen. These activities are coordinated in the framework of the global POPs. UNEP together with WHO and the SC Secretariat are conducting and supporting human milk surveys in developing countries.[148] Suriname has successfully participated in the human milk survey (see Section 2.3.10) and will take further steps to contact the responsible UN agencies to seek guidance and funding options.

*Table 32. Action plan for effectiveness evaluation (Article 16)*

| Objectives | Activities | Performance indicator | Time frame | Implementer |
|---|---|---|---|---|
| Generating updated data on POPs in human milk or human blood | Repeat the monitoring of POPs in human milk extended to more regions in Suriname | Updated data on POPs in human milk with WHO laboratory (pooled sample). | 3 years | CM<br>BOG |
| | Analyse individual samples in BOG laboratory (including capacity building) | Data of selected POPs in human milk of individuals. Understanding on variation and sources of relevant POPs. | 2 years (old samples)<br>5 years (new samples) | BOG |
| Evaluating the effectiveness of the implementation of the Convention by other approach | Develop further national performance evaluation criteria.<br><br>Assessment of the implementation and progress performance | Criteria Developed.<br><br>Assessment report | 1 year<br><br>3 years | CM |

### 3.3.15. Activity: Reporting (Article 15)

According to Article 15 (paraphrased): Parties are required to report periodically on the measures taken, and on their effectiveness in meeting the objectives of the SC. Article 15 of the SC mandates parties to report to the COP on measures taken to implement the provisions of the Convention as well as the effectiveness of the measures taken. In addition, each party is to provide to the Secretariat, statistical data on its total quantities of production, import and export of each of the chemicals listed in Annex A and B as well as list of states from/to which it has imported/exported each of such substances. The Article 15 reports provide a substantial input to the effectiveness evaluation of the Convention (Article 16),and are submitted every four years. This Action Plan therefore aims at collecting/collating all information relevant to the provisions of the Convention and packaging them in a suitable manner for reporting to the secretariat and the COP.

[148] www.who.int/foodsafety/areas_work/chemical-riskschem/pops/en/index1index.html

*Table 33. Action plan for reporting under Article 15 of the Stockholm Convention*

| Objectives | Activities | Performance indicator | Time frame | Implementer |
|---|---|---|---|---|
| Setting up mechanism for article 15 reporting | Develop a mechanism for complying with the reporting requirements by submission of reports within the given deadlines | Mechanism developed | | CM |
| | Setting up responsibilities for data compilation and filling the reporting form | Form filled | 1 year (for 2018 reporting) | |
| Complying with article 15 reporting | Compile information for reporting (updated inventory and other information)<br>Submit report to the secretariat (website) | Reporting submitted deadlines met | 6 months (reporting 2018; then 4-year cycles) | SC Focal Point |

### *3.3.16. Activity: Research, development and monitoring (Article 11)*

Article 11 of the SC mandates parties to undertake appropriate research, development, monitoring and cooperation pertaining to POPs. The participation in the WHO/UNEP human milk survey was one achievement in monitoring POPs in Suriname. More activities are needed, and the development of analytical capacity is a major bottleneck. For POPs research and monitoring, international cooperation with experienced institutions are a promising approach for progress in this topic. In this respect, capacity-building activities offered in the framework of the SC will be considered for possible participation. Additionally, activities in the regional SC Centres will be assessed for possible participation, and contacts have been made to the centre in Brazil. The assessment of POPs-contaminated sites outlined in this action plan will also result in valuable data which will need to be included in a database compiling POPs data generated in the country.

Another relevant research area are alternative assessments to POPs and candidate POPs. Considering the large amount of POPs-like chemicals identified in international research and considering the synergies with SAICM emerging policy issues and issues of concern, a wider framework of research and monitoring-capacity is needed to address these hazardous chemicals and to select appropriate alternatives to POPs and other hazardous chemicals of concern.

Science–policy interfaces are critical in shaping environmental governance and sustainable development. Science has delivered many assessments, syntheses and reviews to inform on chemical pollution and health effects which could facilitate the conventions' implementation. However, science and other forms of knowledge are not used effectively in policymaking; and policymakers do not always effectively inform scientists about their needs for scientific knowledge. An effective science-policy interface is needed and robust institutes or working groups which can generate and compile the necessary science-based information and communicate it in a way that the information can be used for drafting policies.

Suriname has sent a member to the POPs Review Committee, which is working in the science-policy area. Additionally, within the POPRC activities, information on alternatives to POPs is compiled. This section identifies various activities in addressing the research, development monitoring and science-policy needs.

*Table 34. Action plan for research, development and monitoring (Article 11)*

| Objectives | Activities | Performance indicator | Time frame | Implementers |
|---|---|---|---|---|
| Developing institutional and research-capacity to manage POPs and other hazardous chemicals (SAICM synergy) | Identify institutions with the potential to undertake research into POPs and other hazardous chemicals (SAICM Synergy) | Institutions identified, contacted and agreement for cooperation | 3 years | NIMOS<br>ADEKUS<br>VG/BOG<br>LVV/Residue Lab<br>International/regional partner |
| | Strengthen national scientific and technical research-capacity and infrastructure to gather, evaluate and exchange information on chemicals | Needs of national scientific and technical research capabilities relation to POPs and other hazardous chemicals established | 3years | |
| | Develop networks among identified research institutions on national and international level | Networks established<br><br>Researchers participated in international conferences | 3 years | |
| | Establish capacity on health, exposure and risk assessment to POPs and other hazardous chemicals | Report on exposure and risk assessment | 3 years | |
| | Establish outlets for communicating research and development findings to the public | Number science articles in newspapers and reports on chemicals & waste in TV and radio | 5 years | |
| Establishing improved and operative science-policy interface and contributing to decision-making | Assessment of current science-policy interface in decision-making. gaps and improvement need | Gap assessment of science-policy interface (report) | 1 year | CM<br>NIMOS<br>OWTC/VOV<br>Pesticide Board<br>VG/BOG<br>ADEKUS<br>Private Sector<br>International/<br>regional institutions |
| | Establish/improve science policy interface for chemicals and waste/resources for assessing the impact of POPs and hazardous chemicals to the SDGs and indicators, ecosystem services[149] and other policy drivers. | Compilation of impact of hazardous chemicals to SDGs and related indicators<br><br>Science-policy assessment report on chemicals and waste/resources | 3 years | |
| Conducting socio economic assessment, life cycle costing and external cost for policy making | Compile information and develop capacity on life cycle cost, external cost and socio-economic analysis of POPs and other hazardous chemicals | Institute or working group with expertise on external costing and socio-economic established. | 3 years | NIMOS<br><br>ADEKUS |
| | Contribute information on life cycle cost, external cost and socio-economic assessment to the science-policy dialogue | Reports and policy documents for key areas<br><br>Information reached policy makers and are referenced in decisions and policy and legislation background documents | 3 years | |

[149] See http://www.millenniumassessment.org/en/index.html

| Objectives | Activities | Performance indicator | Time frame | Implementers |
|---|---|---|---|---|
| Developing appropriate analytical capacity approach for relevant POPs | Assessment on analytical capacity need (see individual POPs action plans) | Needs assessment | 2 years | International/ regional Partners<br>VG/BOG<br>Other national stakeholders |
| | Develop laboratory capacity for POPs considered relevant for the country | Laboratories established<br>Staff trained<br>Laboratories accredited for required/decided POPs | 5 years | |
| | Identify cooperation partners for POPs and PBT research on regional and international level | Regional or international cooperation established | 2 years | |
| Monitoring POPs and other relevant PBTs needed for the implementation (see individual action plans) | Support the monitoring needs of the action plans of the individual POPs groups (see individual POPs groups) | Sample matrices identified<br>Sampling methods selected<br>Samples collected<br>Analysis results | 5 years | VG/BOG and others |
| Ensure proper generation and management of data | Establish procedures for the management of analysis results and other data<br>Consider recognised guidelines for data generation and interpreting monitoring results and presenting monitoring reports | Procedure for management of analysis results established<br>Good Laboratory Practice used,<br>International standards accredited | 2 years | NIMOS<br>VG/BOG |
| Establishing a mechanism for quality assurance and control of monitoring activities | Establish effective quality assurance and quality control (QA/QC) system | Protocol for ensuring QA/QC in place<br>Procedure for data evaluation developed | 2 years | VG/BOG |
| Research on alternatives to POPs and Green and Sustainable Chemistry | Compilation of information on alternative assessment and research on alternatives | Research project into alternatives to POPs | 5 years | LVV<br>ADEKUS |
| | Develop research into Green and Sustainable Chemistry (G&SC)) | Workshops on G&SC<br>Research project on G&SC | 5 years | |

### *3.3.17. Activity: Technical and financial assistance (Articles 12 and 13)*

The ability of the country to fulfil its obligations under the POPs Convention depends partly on the provision of adequate financial and technical assistance. Suriname needs technical and financial assistance and will seek this assistance when implementing its NIP.

The following actions are suggested to enable the country to obtain the needed financial and technical support required for the successful implementation of activities and actions to be carried out to achieve the POPs overall objectives.

*Table 35. Action plan for technical and financial assistance (Articles 12 and 13)*

| Objectives | Activities | Key performance indicator | Time frame | Implementer |
|---|---|---|---|---|
| Sourcing for technical assistance towards the successful implementation of the Convention (Article 12) | Assessing technical needs<br>Identify sources of technical assistance | Documentation of needs<br>List of sources of technical assistance<br><br>Number of proposals prepared and submitted and acceptance | 2 year | CM<br>NIMOS |
| Sourcing for financial assistance towards the successful implementation of the Convention | Assessing financial needs<br><br>Identify sources of financial assistance<br><br>Request for financial assistance through proposal writing | Studies evaluating and demonstrating financial needs<br><br>List of potential donors identified<br><br>Number of proposals prepared and submitted | 3 year | CM<br>Private sector<br>Consultancies |

## 3.4. Priorities and development/capacity-building proposals

As priority areas for the implementation of the SC, the following areas have been discovered during the inventory development process and the stakeholder workshops including the NIP workshop (March 2018) where priorities have been discussed with relevant stakeholders. The order of the priority areas listed below does not mean a prioritisation between the areas.

The SC activities should be linked and harmonised with national priorities and should support sustainable development. Where possible and appropriate, the implementation of the SC should seek synergies with the implementation of other chemical Conventions and SAICM.

### *I. Strengthening the coordination between institutions and stakeholders*

Several of the listed priorities need the support and cooperation of different government entities, institutions and stakeholders. A strong coordination of activities is needed between the different stakeholders for the effectiveness of the implementation of the action plan. Therefore, the strengthening of cooperation between the different ministries, institutions and other stakeholder is an important factor (priority) for an effective implementation of the Stockholm Convention NIP and the SAICM NAP as well as other activities and synergies on waste and chemical management.

The activity contributes to SDG 3, 4, 11, and 16. It can also contribute to SDG 8 and 9.

### *II. Institutional strengthening and regulatory development and implementation*

Harmonisation and improvement of legislation regulating chemical management is needed. Where gaps have been discovered appropriate legislation should be developed based on the current realities. This is detailed for POPs in the respective action plan in 3.3. Additionally, the SAICM NAP have listed the needed actions for the introduction of efficient chemical management including GHS, requirements for handling chemicals, restrictions regarding the use of chemicals.

Also, the legislation on waste management needs to be improved and the Waste Management Act must be adopted. Several waste fractions containing POPs need specific regulatory frames for waste management (e.g. PCB equipment; e-waste; polymers from end-of-life vehicles, waste oils, waste wood).

There is an urgent need of institutional strengthening of CM and NIMOS with employment of additional staff for chemical and waste management to have the necessary capacity for the important national tasks. Other ministries need institutional strengthening for chemical and waste management. This strengthening of institutions is needed for the development of the appropriate legislation and regulation and the implementation of the regulatory framework and the action plans.

The activity contributes to SDG 3, 4, 8, 9, 11, 12 and 16.

#### *III. Capacity-building, education, information and awareness-raising*

For all POPs groups (Pesticides, unintentional POPs, PCBs, PFOS and related substances, POP-PBDEs, HBCD) education and awareness-raising activities are needed. This includes the education and awareness of the public but also individual stakeholder groups.

The awareness-raising on POPs should be integrated in general awareness-raising on hazardous chemicals. It should give impulse to general education on chemical exposure and health. This also should include awareness and education on waste management for relevant stakeholders. Current awareness campaigns should be continued and strengthened.

Additionally, there is no, or minor knowledge of the POPs newly listed in the Convention. Since some of the new industrial POPs are present in consumer products (electronics, vehicles, synthetic carpets, flame retarded or surface treated textiles, furniture, mattresses, etc.), the establishment of awareness-raising materials and awareness communication should include also the new-POPs.

The activity contributes to SDG 1, 2, 3, 5, 8, 9, 12 and 16.

#### *V. Manage of POPs stockpiles (PCB, pesticides; POP-PBDES, HBCD and PFOS)*

The management of existing POPs stockpiles is considered a priority to protect human health and the environment.

PCB stockpiles are likely present and will be assessed in the regional POPs project to some extent. The PCB-containing equipment and oils which will be discovered in the upcoming inventory activity will need to be exported in future.

Additionally, the buried DDT stock will be excavated and exported.

Large stocks of POP-BFR-containing wastes are present in Suriname in plastics and polymers of e-waste, end-of-life vehicles, insulation in construction and other uses. These polymer materials are openly burned and are “fuel” for landfill fires with associated POPs release, release of particulate matter and black carbon. Furthermore, these plastic and polymers are sources for marine litter and associated pollution.

PFOS stocks especially in firefighting foam are a threat to ground water, drinking water and soil and the use needs to be stopped and stocks managed appropriately.

The activity contributes to SDG 3, 12, 14 and 15.

#### *IV. Improvement of waste management and introduction of waste hierarchy towards sustainable economic development and reduction of unintentionally formed POPs from open burning.*

Open waste burning is the largest source of PCDD/F release. Suriname has limited capacity for waste destruction, and therefore, POPs-containing waste (PCBs; pesticide stocks) require export at high cost. New industrial POPs (viz. POP-PBDEs, HBCD, PFOS and SCCP) can be present in several waste streams (electronic waste, car shredder residues, synthetic carpets, flame retarded or surface treated textiles, furniture, mattresses, rubber, PVC etc.). These wastes are currently all disposed in dumpsites in Suriname. Therefore, and considering other contaminants (e.g. heavy metals) in the waste, the lack of waste management presents a serious threat to soils and related food safety (SDGs 2,3,6, 11,12)[150], to ground water, and the wider environment.

The improvement of waste management is therefore of high priority for current and future control of unintentionally produced POPs release and for the management of new industrial POPs in waste streams

[150] Bell et al (2016) Assessment of POPs contaminated sites and the need for stringent soil standards for food and feed safety. Working document for UNEP Dioxin Toolkit and BAT/BEP group. October 2016.

in Suriname. Current actions to improve the handling of waste and the elaboration of a wider waste management policy should also include the development of a concept to finance waste management.

Furthermore, the introduction and implementation of the waste hierarchy is crucial for recovery of valuable resources contributing to sustainable consumption and production. It also contributes to the reduction of the GHG emission and carbon footprint.

Improvement of waste management and gradual implementation of the waste hierarchy contribute to the integrated and system approach to tackling interconnected issues and generating multiple benefits as aimed in the GEF6 and 7 strategy. At the same time increased recycling lead to job creation and generation and involvement of green and sustainable industries and therefore can catalyse private sector activities.

The activity contributes to SDG 1, 2, 3, 6, 8, 11 and 12.

### *VII. BAT/BEP for Dioxin/UPOPs-reduction and integrated pollutant-prevention and control*

The few facilities listed in Annex C of the SC with relevant PCDD/F release (medical waste incinerator, crematory, iron smelter) do not comply with BAT. The assessment of the facilities revealed that for the EIA the technology itself is not sufficiently described and assessed, and in this respect, improvements are needed in the permitting process. It was revealed that no emission standards are in place in Suriname and that an urgent need to establish emission limits and the related legislation exists. Therefore, there is a need for considering BAT within the EIA and appropriate emission limits. This would be combined with an integrated pollution-prevention and control as mentioned in the Stockholm Convention BAT/BEP guidelines.

The implementation of BAT/BEP contribute to the overall reduction of pollution-release and is an important cornerstone for the overall reduction and control of soil, air and water pollution.

BAT/BEP also can contribute to reduction of energy consumption and related GHG emission.

BAT/BEP with an integrated pollution prevention and control frame of facilities and industries therefore contribute to the integrated and system approach to tackling interconnected issues and generating multiple benefits as aimed in the GEF 6 and 7 strategy.

The activity contributes to SDG 2, 3, 6, 11 and 12 and can contribute to SDG1 and 8 if local working force and technologies are used where possible and appropriate.

### *VIII. Monitoring of POPs, effectiveness evaluation and initiate research and collaborations*

There is a lack of POPs monitoring capacity in Suriname. Initial monitoring data for POPs in human milk have been generated for the country which is the selected matrix for the effectiveness evaluation of the Stockholm Convention. For the implementation of the Convention, further data of human POPs levels are needed for the support of refined priority setting and for an effectiveness evaluation of the implementation of the Convention. Furthermore, data on PFOS and related substances in drinking water are needed. These activities should be combined and could possibly present an impulse for establishing POPs research activities and collaboration.

The activity contributes to SDG 3, 4, 5, 6, 8, 11, 12, 14 and 16.

### *VIII. Substitution POPs and selection of green and sustainable alternatives to promote sustainable development*

Some of the newly listed POPs viz. SCCPs, PFOA, HBCD and DecaBDE are still used in Suriname in products (insulation foams, textiles, PVC, rubber) or in processes (e.g. lubricants, metal working oils, fatliquoring) or lindane for secondary lice treatment. Therefore, assessment and substitution of POPs and POPs-like chemicals are needed. For the non-regrettable substitution[151], strengthening of capacity for alternative assessment and substitution of POPs and POPs-like chemicals considering SAICM synergy is needed.

[151] Fantke P, Weber R, Scheringer M (2015) From incremental to fundamental substitution in chemical alternatives assessment. Sustainable Chemistry and Pharmacy 1, 1-8.

In a second step, the POPs and POP-like chemicals and chemicals in products (SAICM synergy) need to be substituted by green and sustainable chemicals or non-chemical alternatives.

Considering the SAICM synergy in addition to POPs pesticides, also highly hazardous pesticides (HHPs) and other pesticides with serious health threats need to be substituted by more sustainable alternatives contributing to SDGs and to GEF Strategic Priorities[152].

Furthermore, the substitution of highly persistent and water soluble PFOS, PFOA and other PFAS (SAICM synergy) contribute to Enhancing Water Security (GEF International Water Focal Area).

The activity contributes to SDG 3, 4, 6, 8, 9, 12, 14 and 16. The use of green and sustainable chemicals also contributes to SDG 2, 14 and 15.

#### *IX. Contaminated site assessment and management*

The assessment and inventory in this NIP update revealed that for all POPs groups (Pesticides, PCBs/PCNs, Dioxins/UPOPs, PFOS and PBDEs) a range of sites are possibly or likely contaminated. Contaminated sites negatively impact several SDGs. Currently, there are only preliminary assessments and initial measurements for one PCB storage site and samples were sent to the laboratory for some potential pesticide-contaminated sites. Therefore, it is of high priority to initiate a more comprehensive assessment, mapping and securing of POPs-contaminated sites such as those with potential contamination of ground and drinking water with PFOS or sites where food-producing animals are grazing/feeding. These activities should result in the establishment of a database of contaminated-sites in Suriname.

The activity contributes to SDG 3, 6, 11, 14 and 15.

A range of activities in the different action plans is linked to these high priority areas. These activities are not repeated here but can be found in the action plans described in the different areas and are listed in the action plan tables above (see Section 3.3).

## 3.5. Timeframe for the implementation strategy and action plans

The individual action plans and activities developed and compiled in Section 3.3 contain individual timeframes for implementation of the individual activities. Time frames are short-term (2 years and less), medium term (3 to 5 years) and long term (10 years).

## 3.6. Resource requirements

For the priority areas, tentative budget requirements have been estimated (Table 36). Suriname is aware that the financial resources from GEF and other UN funding do not sufficiently cover the full implementation costs; hence, co-funding must be considered. Therefore, potential sources of funding have been identified. Details on co-funding will be elaborated on during the respective development of projects.

The government shall ensure the necessary resources, while mobilising the contributions of international financing sources for the NIP implementation. The Government should create a legal basis and favourable conditions to encourage and attract the participation of all related economic sectors, domestic and foreign organisations, as well as investors for the implementation of the National Plan. In addition, National Plan implementing authorities should take maximum advantage of the financial resources allocated by international financial organisations and other countries by conducting appropriate campaigns to attract capital from donors for the National Planning, creating a legal basis to encourage international sponsorship.

A detailed budget for an activity will be calculated during development of individual projects.

[152] GEF (2017) GEF-7 REPLENISHMENT OVERVIEW: GEF-7--GLOBAL CONTEXT AND STRATEGIC PRIORITIES. December 22, 2017, GEF/R.7/11.

This framework will take into consideration and identify specific human resources, stakeholder contributions and requirements for possible GEF incremental cost and funding by development/donor partners.

Considering the larger share of co-funding needed for GEF projects, appropriate and robust co-funding sources and approaches are needed. Following approaches and strategies are considered for co-funding:

- The SC NIP will be coordinated and integrated where appropriate with other related national plans and programs on waste management, resources management, sustainable development, climate change, or programs or projects on science and technology, to attract investments and increase capital efficiency. By linking to general chemical and waste management, co-funding can partly come from national budgets dedicated to chemical and to waste management.
- For the management of POPs-contaminated stocks and wastes, extended producer responsibility (EPR) contributions can become an important funding source for the environmentally-sound management of waste fractions. Several waste fractions related to POPs can be addressed by an extended producer responsibility frame:
  - E-waste including e-waste plastic
  - End-of-life vehicle (including the polymers)
  - Empty pesticides containers and stockpiles
  - Synthetic carpets
- The implementation of extended producer responsibility needs the development of a respective policy and regulatory framework. Such a framework already exists in some countries for some of the categories.
- Since a range of POPs are included in consumer products, also the consumer must bear a part of the cost by appropriate waste management fees.
- In the set-up of funding of the waste management, the value of the waste needs to be considered as co-financing source. E.g. vehicles have an inherent value (US$ 200.-- to US$ 400.--) mainly from metals and this value should be used to also manage the non-valuable fraction of plastic and other polymers and pollutants. Certain e-waste fractions have a value and can contribute to the finance of e-waste management. This requires the development of a waste management framework which allow the separation of valuables like metals ("cherry picking") without consideration on managing the remaining non-valuable fractions.

- Owners of POPs waste must contribute a considerable share of the management cost:
  - Owners of PCBs (utility sector) have major responsibility for a large share of the PCB-containing transformers and other equipment
  - PFOS firefighting foams
  - End-of-life vehicle (including the polymers)
- The improvement of recycling and recovery schemes also can contribute to financing of waste management including POPs management. E.g. from experience in Europe, more than 50 % of e-waste plastic can be recycled after separation with a reasonable price for the separated plastic fraction. The separation of recyclable plastic at the same time reduces the volume of the plastic fraction to be treated.
- The polluter pays principle (PPP) can likely be used in the area of contaminated sites and hot spots. Before the principle can be applied the related regulatory framework need to be set-up that the PPP can be used as co-financing source.

The NIP will be implemented through mobilisation of various finance resources such as state budget, bilateral grant aid, GEF grants, extended producer responsibility contribution, polluter pays principle contributions, loan, financing from organisations and individuals, etc.

The elaboration, allocation, and cost estimate decisions, as well as the management, use and settlement of funds for implementation of the National Plan should be conducted in accordance with regulations.

Strengthening international cooperation should be carried out in various areas such as technical cooperation, grant aid for project development, improve capacity, institutional improvement, supporting under projects, resolving health and social benefits problems for the stakeholders.

Table 36 gives an overview on budget estimates for priority activities for POPs management in Suriname. These budgets are indicative and are rough estimates. Some activities cannot be estimated since the necessary data are not available but are generated during the implementation of the NIP. E.g. the cost for the PCB management can only be estimated after the inventory has revealed the amount of PCB-containing transformers. Similarly, the management of PFOS-containing firefighting foams can only be estimated if a decision is made that the use of the foams are not allowed anymore and need to be destroyed or if the remaining foams will still be allowed to be used. The cost for the management of PBDE can only be calculated within the overall management of e-waste, end-of-life vehicle and other impacted wastes. Only after such a framework is established and the approach for plastic/polymer management from e-waste and ELVs is clarified (separation/recycling or just disposal or energy recovery) the cost for the treatment of POP-containing plastic/polymers can be calculated.

As described above, the financing of the suggested budget would be a mix of governmental funding, international funding and funding from industries and citizens. E.g. the estimated cost for contaminated site assessment would come also from the owner of potentially contaminated sites like the airport. Furthermore, the proposed activities can partly be financed by the regular waste management budget since PBDE in e-waste or end-of-life vehicles belongs to the general waste management tasks of the country. Here funding can come largely from extended producer responsibility and for vehicles and some of the electronics co-funding can from the value of the resources in the waste.

Integrated implementation with other national activities can be a (co-) funding source. As an illustration, for the SAICM national action plan (NAP), a budget estimate has been developed. If the SAICM NAP is implemented, a range of activities like the coordination mechanism, strengthening institutions, regulatory development and implementation of chemical and waste management can be done in a synergistic and integrated manner with shared or merged budgets.

*Table 36. Estimated budget for priority activities for POPs management in Suriname*

| **Priority Activities (details are in individual action plans)** | **Estimated Budget in US $** |
|---|---|
| Coordination, institutional strengthening, regulatory development and implementation | |
| Coordination mechanism between ministries, institutions and stakeholders for POPs and chemical and waste management (SAICM synergy)* | 300,000 |
| Strengthening governmental institutions including employment of further staff (SAICM synergy)* | 750,000 |
| Development of policy, legislation and regulatory (SAICM synergy)* | 400,000 |
| Guiding the implementation of the regulatory framework (SAICM synergy)* | 250,000 |
| Education, information, and awareness-raising | |
| Information and awareness-raising on POPs, hazardous chemicals and chemistry[153] for general public (SAICM synergy) | 500,000 |
| Education and awareness-raising in curricula | 150,000 |

[153] The use of functional chemicals is a necessity in daily life. In addition to education on the risks of POPs and other hazardous chemicals, also the basics of chemistry of chemicals used in everyday life would be included in the education including benefits and drawbacks for informed decisions on use.

| **Priority Activities (details are in individual action plans)** | **Estimated Budget in US $** |
|---|---|
| Please note: Education and capacity for expert is in individual priority action below | |
| Manage of POPs stockpiles (PCBs/PCNs, pesticides; POP-PBDES, HBCD and PFOS) | |
| Maintain and improve technical capacity for better management of obsolete POPs pesticides and HHPs (PSMS; Hazmat) | 200,000 |
| Management of buried DDT stockpile | 50,000 |
| Inventory development of PCBs | 200,000 |
| Knowledge and technical capacity for the management of PCBs | 60,000 |
| Management of PCB-containing transformers and wastes | Estimate after inventory |
| Knowledge and technical capacity for management of POP-BFRs-containing waste (WEEE, ELVs, others) | 200,000 |
| Management of POP-PBDE-containing waste | Within the management of WEEE and ELVs (see below) |
| Management of HBCD-containing stock | Estimate after inventory and stop of further use |
| Education and knowledge capacity for management of PFOS and PFAS- (SAICM synergy) containing waste (Firefighting foams, carpets, treated textiles, furniture, paper etc.) | 200,000 |
| Management of PFOS-containing waste | Estimate after decision if PFOS foams/waste need destruction |
| Improvement of waste management and introduction of waste hierarchy and reduction of unintentionally formed POPs from open burning. | |
| Improvement of waste management of waste categories containing POPs (WM) (e.g. WEEE; ELV, waste oil, waste wood, carpet) | Cost depend on recovery of cost by recycling, reuse & reduction |
| Overall improvement of waste management for reduction of open burning of dumps/landfills and on private level | Cost depend on recovery of cost by recycling, reuse & reduction |
| Assessment of options for destruction of POPs-containing waste in Suriname or the region and developing frameworks | Cost depend if own capacity |
| Awareness, education and capacity-building of stakeholders (industries, authorities and the public) on reduction, reuse and recycling (3R), waste separation. | 400,000 |
| BAT/BEP for Dioxin/UPOPs reduction and integrated pollutant prevention and control | |
| Knowledge and technical capacity for the control and reduction of PCDD/F and other UPOPs | 75,000 |
| Implementation of BAT and/or BEP for UPOPs sources (medical waste incinerator, iron smelter, crematory, chlorine production) | Facilities need a detailed assessment for cost estimate |
| Monitoring of POPs, effectiveness evaluation and initiate research and collaborations | |
| Update inventories, databases for POPs, hazardous chemicals, pollutant releases/PRTR (SAICM synergy) | 400,000 |

| Priority Activities (details are in individual action plans) | Estimated Budget in US $ |
|---|---|
| Knowledge-development for analysis/monitoring of POPs and other priority pollutants (SAICM synergy) | 100,000 |
| Development and improvement of technical analytical capacity | 750,000 |
| Network development and cooperation with international partners for monitoring and assessment of POPs and POPs-like chemicals | 250,000 |
| Monitoring projects in priority area | 500,000 |
| Substitution POPs and selection of green and sustainable alternatives | |
| Capacity-building for the assessment of alternatives chemicals and non-chemical alternatives and green/sustainable chemistry | 150,000 |
| Substitution of POPs in use (SCCP, PFOA, PFOS, HBCD) by more green and sustainable chemicals and non-chemical alternatives | Estimate after assessment of very recent listed POPs in use |
| Contaminated site assessment and management | |
| Capacity-building for the assessment, inventory, securing and remediation of POPs-contaminated sites | 200,000 |
| Database for contaminated sites | 100,000 |
| Assessment of pesticides-contaminated sites | 300,000 |
| Securing and possibly remediation of pesticides-contaminated sites | Estimate after assessment |
| Assessment of PCB-contaminated sites | 300,000 |
| Securing and possibly remediation of PCB-contaminated sites | Estimate after assessment |
| Assessment of PFOS/PFAS-contaminated sites | 750,000 |
| Securing and possibly remediation of PFOS/PFAS-contaminated sites and cleaning of drinking water if pollution discovered | Estimate after assessment |
| Assessment of POP-BFR-contaminated sites | 100,000 |
| Securing and possibly remediation of POP-BFR-contaminated sites | Estimate after assessment |
| Assessment of Dioxin/UPOPs-contaminated sites | 300,000 |
| Securing and possibly remediation of Dioxin/UPOP-contaminated sites | Estimate after assessment |
| | |
| **Estimated Costs for Quantifiable Priority Actions** | **7,935,000** |

# Appendix

## Results of the former POPs pesticide site inventory in Suriname

Please note that the pesticide stockpiles have been removed but the contaminated soils have not been assessed or removed.

| | Site/store affected | Commercial name | Toxicity Group (WHO) | Type of Container | Condition of Container | Number of containers | Quantity Kg | Quantity Ltr | Soil $m^3$ | Comments/Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Marienburg-Commewijne | HCH | II | Jute + Plastic bag - 25 kg | Bad | 0 | 4,000 | 0 | **50** | Originally 10,000 kg, seems much less now. Totaly wet, roof leaking |
| | | Endrin | Ib | Metal drum - 200 Ltr | Corroded | 0 | 0 | 0 | | Gone, leaked from drums |
| **2** | Fernandes Paramaribo | Stam-LV-1 | III | Metal drum - 20 ltr | Corroded | 4 | | 80 | | Leaking |
| **3** | Peperpot Commewijne | Cupravit | | Bags | Broken | | | | 5 | Quantity of contaminated soil is unkown |
| | | Bravo | | | | | | | | |
| **4** | Oryza-Saramacca | Propanil | III | Metal drum - 200 Ltr | Bad and corroded | 6 | 0 | 1,159 | | Quantity of contaminated soil is unkown |
| | | Azodrin | | | | | 0 | 0.4850 | | |
| **5** | Landbouwproefstation - Paramaribo | Lasso | | Metal drum | Bad and corroded | 1 | 10 | | | Quantity of contaminated soil is unkown |
| | | Daconate | | Plastic drum | Good | 1 | 4 | | | |
| | | Maneb | III | Bag | Bad | 1 | 2 | | | |
| | | Several pesticides | | Bags (4), bottles in plastic bags | Bad | 4 | 100 | ? | | |
| **6** | BOG-Paramaribo | DDT | | Mixed with Dibrom | Bad | | 550 | | **10** | Buried |

| | Site/store affected | Commercial name | Toxicity Group (WHO) | Type of Container | Condition of Container | Number of containers | Quantity Kg | Quantity Ltr | Soil $m^3$ | Comments/Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **7** | Bacove steiger | Peltis | | Barrel | Bad | 1 | | 20 | | Quantity of contaminated soil is unkown |
| | | | | | Bad | 12 | | | | |
| | Punwasi, Kwattaweg | Diquat | | Metal drum - 200 liter | Corroded | 1 | | 175 | **10** | Leaking |
| **8** | Slootwijk-Commewijne | Azodrin | Ib | Metal drum - 200 Ltr | Corroded | 0 | 0 | 300 | | At least 20 liter present and quantity of contaminated soil is unkown |
| | | Nuvacron | Ib | Metal drum - 200 Ltr | Corroded | 0 | 0 | 300 | | |
| **9** | Nw. Nickerie-Nickerie | Fen-ox | | Bottle - 1 ltr | Affected | 38 | | 38 | | Bottles flattened and quantity of contaminated soil is unkown |
| | | Mite-ox | | Bottle - 0.5+1 ltr | Affected | 7 | | 5 | | Bottles flattened |
| | | Karatox | II | Plastic bottle - 0.5 ltr | Affected | 72 | | 36 | | Bottles flattened |
| | | Bravox | III | Plastic bottle - 0.5 ltr | Affected | 27 | | 13.5 | | Bottles flattened |
| | | Actox | III | Plastic bottle - 0.5 + 1 ltr | Affected | 26 | | 13 | | Bottles flattened |
| **10** | Wageningen-Nickerie | Klerat | Ia | Plastic bag | Good | 0 | 200 | 0 | 500 | |
| | | Dalapon | II | Paper bag - 20 kg | Good | 0 | 4,000 | 0 | | Part of a trench at the back of the barn is used to dispose empty packaging. |
| | | Etrofolan | II | Cardboard drum - 50 kg | Good | 0 | 10,780 | 0 | 10 | Trench was used to burn empty packaging for years |
| | | Arrosolo | II | Metal drum - 200 ltr | Rusty | 0 | 0 | 220 | | |

| | Site/store affected | Commercial name | Toxicity Group (WHO) | Type of Container | Condition of Container | Number of containers | Quantity Kg | Quantity Ltr | Soil m³ | Comments/Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Frescon | III | Metal drum - 100 ltr | Rusty | 0 | 0 | 331 | | |
| | | Malariol | ? | Metal drum - 200 ltr | Rusty | 0 | 0 | 2,459 | | |
| 11 | Jules Chen | Sulfamethion ? | | | | | | 1 | | Quantity of contaminated soil is unkown |
| 12 | Suradel, Franchepanestr. Par'bo | Top Crop Flowable | | Jerrycan | Good | 31 | | 279 | | |
| 13 | Bacove steiger | Benlate SP | | Carton box | Good | | 1 | | | Quantity of contaminated soil is unkown |
| | | Derosal 500g/l | | Plastic bottle | Good | 338 | | 1,690 | | |
| | | Bravo C/M | | Paper bag | Good | | 460 | | | |
| | | Calixin | | Barrel | Good | 1 | | 200 | | |
| | | Counter | | Paper bag | Good | 48 | 960 | | | |
| | | Mertect 340 F | | Plastic jerrycan | Good | 166 | | 1,257 | | |
| 14 | Nickerie | Derosal 500g/l | | Plastic bottle | Good | | | 600 | | Quantity of contaminated soil is unkown |
| | | Calixin | | Barrel | Good | 4 | | 800 | | |
| | | Counter | | Paper bag | Good | | 740 | | | |
| | | Fungaflor | | Paper bag | Good | | 77 | | | |
| 15 | Jarikaba | Mertect 220 SL | | Plastic jerrycan | Good | | | 100 | | Quantity of contaminated soil is unkown |
| | | Diazinox | | Plastic bottles | Good | | | 16 | | |

| | Site/store affected | Commercial name | Toxicity Group (WHO) | Type of Container | Condition of Container | Number of containers | Quantity Kg | Quantity Ltr | Soil $m^3$ | Comments/Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **16** | Bergwijn - Wanica | Furadan | II | Plastic bags - 25 kg | Good | 70 | 1,750 | | | Property of GPOV (semi-gov). Quantity of contaminated soil is unkown |
| **17** | Surland rijstbedrijf | NaPCP | | | | | | | | |
| **18** | Apura/Blaka watra | 2,4,5-T | | | | | | | | Buried, Quantity of contaminated soil is unkown |
| **19** | Apura/Moeroekreek | Wolman salts | | | | | | | | |
| **20** | Victoria-Brokopondo | Gesapax 80 | III | Plastic bag - 1 kg | Good | 0 | 10 | 0 | | |
| | | Endrin | Ib | Metal drum - 200 ltr | Good | 0 | 0 | 100 | | |
| | | Malathion | III | Metal drum - 200 ltr | Good | 0 | 0 | 50 | | |
| | | Propanil | III | Plastic bottle - 1 ltr | Good | 0 | 0 | 12 | | |
| | | Na Arsenite | I b | Glass bottle - 1 ltr | Good | 0 | 0 | 2 | | |
| **21** | Tijgerkreekwest-Saramacca | Chloor ipc | | Metal drum | Bad | 9 | | 1,800 | | REPACKED |
| | | | | | | | **23,644** | **12,057** | **585** | |

| | |
|---|---|
| **Direct risks** | **Latent risks** |
| **Risks** | **Unknown** |
| **Potential Risks** | **No risks assessed repacked** |