THE REPUBLIC OF UGANDA

NATIONAL IMPLEMENTATION PLAN II (NIP II) FOR THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS (POPs) (2016- 2025)

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

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NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)
P.O. Box 22255
Kampala Uganda
info@nemaug.org
http://www.nemaug.org

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FOREWORD

The Stockholm Convention (SC) was adopted in May 2001 with the objective of protecting human health and the environment from toxic and hazardous Persistent Organic Pollutants (POPs). The Convention entered into force on 17th May 2004, initially listing twelve chemicals as POPs. Uganda acceded to the Convention on the 20th July 2004 and in fulfilment of Article 7 of the Convention; developed and transmitted her first (original) National Implementation Plan (NIP) in 2009 to the Conference of Parties (COP). At its 4th meeting of the Conference of Parties in May 2009, the SC was amended to include new POPs in Annex A (*Alpha hexachlorocyclohexane, Beta hexachlorocyclohexane, Chlordecone, Hexabromobiphenyl, Hexabromodiphenyl ether and heptabromodiphenyl ether, Lindane, Tetrabromodiphenyl ether and Penta bromodiphenyl ether Pentachlorobenzene* (also listed in Annex C) and Annex B (*Perfluorooctane sulphonic acid (PFOS), its salts and Perfluorooctane sulfonyl fluoride*), respectively.

This revised NIP for the SC on POPs incorporates the aforementioned additions to the Annexes and is a major undertaking by Government of Uganda (GoU) to minimise the impacts of POPs in Uganda and beyond Uganda. The process of reviewing and updating the NIP started in 2014 under the Project entitled *"Enabling activities to review and update the NIP for SC on POPs"* which was funded through the Global Environment Facility (GEF) with technical oversight from the United Nations Industrial Development Organization (UNIDO). The project consisted of four major components: (i) Coordination mechanism and awareness raising; (ii) Inventories of new POPs and NIP review; (iii) National capacities assessment and priority setting for management of new POPs and (iv) NIP formulation, endorsement and submission.

National Environment Management Authority (NEMA) was the executing agency for the project, supported by stakeholders from Government and non-governmental agencies, private sector and Civil Society Organisations (CSO). The multi-institutional National Coordination Committee (NCC) for the project consisted of representatives from the National Environment Management Authority (NEMA); Makerere University, the Ministry of Finance, Planning and Economic Development (MFPED); Uganda National Bureau of Standards (UNBS); Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Ministry of Tourism, Trade and Industry (MTTI), Ministry of Health (MoH), Ministry of Water and Environment (MWE), the Ministry of Gender, Labour and Social Development (MoGLSD); Uganda Revenue Authority (URA); Uganda Cleaner Production Centre (UCPC); and Uganda Manufacturers Association (UMA).

Notably, the management of POPs in Uganda is very relevant to day-to-day activities of institutions, households and industry. For example, the sources of Poly Brominated Diphenyl Ethers (PBDE) emissions are old electrical and electronic equipment (EEE; mostly imported as second hand EEE) such as computers, CRT computer monitors and TVs and end-of life-vehicles (ELVs) where PBDEs were used as flame retardants in plastics and foams. Unintentional POPs are produced from open burning of waste, such as plastics, paints, oils and industrial combustion at low temperatures. Furthermore, poor handling of transformer oils is suspected to be a key factor in the cross contamination and proliferation of PCBs in the country. Therefore, this comprehensive and nationally accepted revised NIP is necessary for sound and sustainable management of POPs and related substances in Uganda.

Lastly, this NIP provides a means of balancing the country's development priorities, human welfare, environmental and socio-economic concerns in the management of POPs and compliance with national laws and the Stockholm Convention. I wish to congratulate all the stakeholders that have been involved in developing this NIP for the good work done and I assure them of Government's commitment and support during its implementation.

It is my great hope that this revised NIP meets the expectations of all Ugandan citizens and the support of all stakeholders who will be involved in its implementation.

HON. CHEPTORIS SAM
MINISTER OF WATER AND ENVIRONMENT

ACKNOWLEDGEMENTS

The preparation of this revised NIP was a national effort involving a number of stakeholders, including, Ministries, Government Departments and Agencies (MDAs); the Private Sector, Non-Governmental Organizations and the general public. Input from most of the stakeholders has been used to prepare the revised NIP; its preparation process spanned across the tenure of the Minister of Environment and Water, Prof. Ephraim Kamuntu. It is with deep gratitude that we place on record the unstinted support provided by the Hon. Minister that led to the successful completion of the revised NIP document.

The valuable assistance and guidance that was provided by members of the National Coordination Committee are highly appreciated, namely: *Dr. Agaba Friday – National Drug Authority, Ministry of Health; Dr. F. M. Nsubuga – Ministry of Gender, Labour and Social Development; Dr. John Wasswa – Chemistry Department, Makerere University; Emmanuel Kaye –Directorate of Government Analytical Laboratory, Ministry of Internal Affairs ; John Mwanja – Crop Protection Department, Ministry of Agriculture, Animal Industry and Fisheries; Fauza Namukuve – Ministry of Water and Environment; Mubaraka Kirunda Nkuutu – Uganda Manufacturers Association; Robert Tumwesigye - Pro Biodiversity Conservationists in Uganda; Wilbur Nsiyona Bukosi – Customs Department, Uganda Revenue Authority; Silver Ssebagala – Uganda Cleaner Production Centre; Susan Okodi - Ministry of Foreign Affairs; Aziz Mukota - Uganda National Bureau of Standards; Innocent Ejolu - Office of the Prime Minister; Angella Rwabutomize- Ministry of Finance, Planning and Economic Development; Pauline Akiidi- Ministry of Finance, Planning and Economic Development ; Kassim Semanda - Ministry of Trade, Industry and Cooperatives ; Dr. Gerald Sawula, Waiswa Ayazika, Aristarco Kasekende, Fred Onyai and Christine Kasedde, – National Environment Management Authority.*

The Global Environment Facility (GEF) through the United Nations Industrial Development Organization (UNIDO) provided the bulk of the funding for this project without which the project would not have materialized. We offer our gratitude and thanks to them for the provision of managerial expertise and advice on NIP preparation. Particular mention is made of the Task Managers for Enabling Activities at UNIDO, namely, Ms. Erlinda Galvin and the International Consultant Prof. Komla Sanda who advised and guided the National Project Coordination team in project implementation. They have been particularly helpful in the review and advice on the completion of the inventories and this NIP.

Finally, I would like to extend special thanks to the Project Coordination Unit (PCU) at NEMA, which consisted of Christine Kasedde, Richard Nyenje and Jascinta Nalwoga and the various Inventory Consultants and resource persons namely: Dr. Kenneth Arinaitwe, Moses Masiga, Stephen Byantwale, Patrick Kamanda, Dr. Ananias Bagumire, Nancy Awori, Emmanuel Kaye and Assoc. Prof. Okot Okumu, for their dedication, commitment and professional contribution.

I wish you all good reading but above all dedicated implementation of the revised NIP.

DR. TOM O. OKURUT
EXECUTIVE DIRECTOR, NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

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ABBREVIATIONS AND ACRONYMS

a	Year (annum), 365 days
ADI	Acceptable Daily Intake
AFFF	Aqueous Film Foaming Foam
AHF	Aviation Hydraulic Fluid
AJAF	Entebbe Aviation Joint Facility
APC	Air pollution control(system)
BAT	Best Available Techniques
BAT	British American Tobacco
BEP	Best Environmental Practices
BFRs	Brominated Flame Retardants
CAA	Civil Aviation Authority
CCD	Climate Change Department
CEOs	Chief Executive Officers
COP	Conference of Parties
CSOs	Civil Society Organisations
DDT	Dichlorodiphenyltrichloroethane
EEE	Electrical and Electronic Equipment
EIA	Environment Impact Assessment
EPA	Environmental Protection Agency
ESM	Environmentally Sound Management
EtFOSA	N-Ethyl perfluorooctane sulfonamide
FAO	Food and Agricultural Organisation (of the United Nations)
FFF	Fire Fighting Foam
FFFP	Film Forming Fluoro Protein
FIRI	Fisheries Research Institute
FORRI	Forestry Resources Research Institute
g	Gram (mass unit)
GAL	Government Analytical Laboratory
GEF	Global Environment Facility
GoU	Government of Uganda
HACCP	Hazard Analysis Critical Control Point
HBB	Hexabromobiphenyl
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HW	Hazardous waste
IPM	Integrated Pest Management
IRS	Internal Residual Spraying
IVM	Integrated Vector Management
KACITA	Kampala City Traders Association
KARI	Kawanda Agricultural Research Institute
LHRI	Livestock Research Institute
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MCC	Multi-sectoral Coordination Committee
MCP	Malaria Control Programme
MDAs	Ministries, Departments and Agencies
MDGs	Millennium Development Goals
MEA	Multilateral Environmental Agreements
MFPED	Ministry of Finance Planning and Economic Development

MoH	Ministry of Health
MRL	Maximum Residue Limits
MTIC	Ministry of Trade Industry and Cooperatives
MUK	Makerere University Kampala
MWE	Ministry of Water and Environment
NAARI	Namulonge Agricultural and Animal Production Research Institute
NCC	National Coordination Committee
NDA	National Drug Authority
NEMA	National Environment Management Authority
ng	Nanogram 10^{-9} g
NIPs	National Implementation Plans
OCED	Organization for Economic Co-operation and Development
OPUL	Oil Palm Uganda Limited
PBBs	Polybrominated biphenyls
PBDEs	Polybrominated diphenyl ethers
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PeCBz	Pentachlorobenzene
PFAS	Perflouroalkyl sulfonate
PFOA	Perfluoroocatane acid
PFOS	Perflorooctane Sulfonic Acids
PFOS-F	Perflorooctane Sulfonyl Floride (PFOS-F)
POPs	Persistent organic pollutants
PSV	Public Service Vehicle
PUR	Polyurethane
SAARI	Serere Agricultural and Animal Production Research Institute
SAICM	Strategic Approach to International Chemicals Management
SC	Stockholm Convention
SCOUL	Sugar Corporation of Uganda Limited
SPS	Sanitary and PhytoSanitary
t	Ton 10^{6} g (1,000 kg)
t/a	Ton per annum
TEF	Toxicity equivalency factor
TEQ	Toxic equivalent Quantity
TLB	Transport Licensing Board
UAE	United Arab Emirates
UBOS	Uganda Bureau of Statistics
µg	Microgram 10^{-6} g
UK	United Kingdom
UNBS	Uganda National Bureau of Standards
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNIDO	United Nations Industry Development Organisation
UNITAR	United Nations Institute for Training and Research
UPOPs	Unintentional Persistent Organic Pollutants
URA	Uganda Revenue Authority
USA	United Sates of America
WEEE	Waste Electrical and Electronic Equipment
XRF	X-Ray Fluorescence

EXECUTIVE SUMMARY

Stockholm Convention (SC) on Persistent Organic Pollutants (POPs) is a global treaty adopted on 22nd May 2001 and entered into force on 17th May 2004. The Convention seeks to protect human health and the environment from chemicals that remain intact in the environment for long periods of time, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife. To date, there are 26 chemicals listed as POPs, of which 23 are currently legally binding. These chemicals include agricultural pesticides, industrial chemicals and some unintentionally produced chemicals from anthropogenic processes. The Convention seeks to eliminate production and use of chemicals listed under Annex A of the Convention text, restrict production and use of those listed in Annex B and through Best Available Techniques (BAT) and Best Environmental Practices (BEP) reduce emissions and releases of POPs from anthropogenic sources (Annex C chemicals).

Uganda ratified the Stockholm Convention on 20th July 2004 and in fulfilment of Article 7 of the Stockholm Convention, the country developed her first National Implementation Plan and submitted it to the Secretariat of the Conference of Parties to the Stockholm Convention in January 2009. Following the addition of ten new POPs to the original twelve, it was imperative for the Parties to review and update their NIPs. By Decision SC-2/7 of the Conference of the Parties (COP) to the SC in 2006, *"Parties are required to submit updates to their National Implementation Plan (NIP) within two years of the entry into force of any amendments."* Similarly, according to Article 7 of the Stockholm Convention, parties are obliged to review and update, as appropriate, their implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties. Thus, Government of Uganda has prepared this document as an update to the first NIP in order to fulfill her obligations, under the SC and with respect to the POPs, to inform the COP, the general public and to protect the health of the people of Uganda and their environment.

Government commitment in implementing the Stockholm Convention

The Government of Uganda is committed towards implementing the strategic areas of interventions identified in this NIP document. The revised NIP was developed in line with the National Development Plan (NDPII 2015-2020) which is the second in a series of six 5-year Plans aimed at achieving Uganda Vision 2040. NDP major objective is "*to promote and ensure the rational and sustainable utilization, development and effective management of the environment and natural resources for socio-economic development of the country*". The Environment and Natural Resources (ENR) sector made a submission on chemicals management in the second National Development Plan, including POPs management as a specific category. This revised NIP document seeks to contribute towards attaining sound management of these chemicals in the ENR sub-sector of the NDP.

Progress in implementing the Convention

Through a 5 year regional project (2011-2016), '*Capacity Strengthening and Technical Assistance for the Implementation of Stockholm Convention National Implementation Plans (NIPs) in African Least Developed Countries (LDCs)*', Uganda has implemented some of the priority areas of action recommended in the first NIP; including:

(i) POPs and other chemical management aspects have been included into the revised National Environment Act.

(ii) Preparation of draft sound chemical management regulations including POPs issues. The regulation, however, is still in draft form and awaits finalization and operationalization.

(iii) Raising awareness of POPs and other chemicals related to multilateral environmental agreements among district level staff. There is still need for wider scale awareness-raising and education campaigns and trainings among all levels of the population.

(iv) Building national capacity to identify and assess sites which are contaminated by POPs.

(v) Initiation of action to establish a national network for chemical information exchange.

Uganda also participated in the first phase of the project, ‘Supporting the Global Monitoring Plan on POPs in the Eastern and Southern African region’. The project built capacity of staff at the Directorate of Governmental Analytical Laboratory (DGAL) in analysis of POPs in human milk and monitoring of POPs in air. Since the completion of her first NIP, Uganda has actively participated in the global negotiation meetings and Conference of Parties that are held after every two years.

Key issues arising from NIP Update Assessments

From the inventories conducted throughout the country between November 2014 and April 2015, the key findings with respect to management of POPs were as follows:

(1) POPs are not intentionally produced in Uganda; they are mainly imported as pesticides and in consumer articles.

(2) Major POPs imported into the country include:

(i) **Endosulfan pesticide** with wide applications in Agriculture. This agricultural pesticide is mainly used on coffee against coffee borers and cotton bollworm. There is a planned phase-out while promoting cost effective alternatives.

(ii) **Polybrominated diphenyl ethers (PBDEs**) in transport and electronic sectors. The most likely sources of PBDE emissions are old Electrical and Electronic Equipment (EEEs) imported into the country, such as, computers, Cathode Ray Tube (CRT) computer monitors, TV sets and end-of-life vehicles (ELVs) in which PBDEs were used as flame retardants.

The inventory concluded that 69% of the 3 million (2,070,000) TVs in Uganda are CRTs. In 2014, Uganda generated 33,000 tonnes of domestic e-wastes, 25% of which consisted of plastic components estimated to contain about 1.2 to 6 tonnes of OctaBDEs.The conservative estimate of Octa-BDEs in imported articles (CRT computers and TVs) was 13 kg while the amount stocked in households was estimated to be 54,000 kg. The estimated amount of Penta-BDEs in currently used vehicles and those that have reached their end of life was 8,462 Kg.

(iii) **Perfluorooctane sulfonate (PFOS)** in fire fighting foam, textiles, synthetic leathers, shoes and bags. *The four (4) main priority issues arising from this assessment are:*

- Large amount of PFOS is present in PFOS-containing synthetic textiles and leather articles and products imported into the country;
- Large quantity of PFOS is contained in the wastes of PFOS-containing articles and products, especially synthetic textiles, synthetic leather and carpets, collected at waste dumpsites;
- Large stocks of PFOS are contained in fire fighting foams (FFFs) and the various contaminated sites where FFFs have been applied;
- There are chemical wastes which contain PFOS, especially, FFFs and hydraulic fluids whose disposal is not monitored.

(iv) **Polychlorinated biphenyls (PCB)**

These are found in PCB contaminated transformer oils and equipments. Waste associated with PCB contamination is not being managed in an environmentally sound manner, although companies have demonstrated willingness to do so. Scrapped power transformers are stored in the open yard because there is no policy for their disposal. In some cases, faulty transformer oils are stored in the open and unpaved yard with the potential risk to the environment. The final destinations of used oils and scrapped distributions transformers are not certain although companies claim to use the services of licensed waste handlers.

(3) Polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/PCDF, commonly called dioxins and furans)

Plausible emission sources for these POPs mainly include medical waste incinerators, iron and steel production, open waste burning and accidental fires, amongst others. The estimated total release of UPOPs for 2014 was 3823 g TEQ/a compared to the 2007 estimate of 1370 g TEQ/a. According to inventory results recorded, air is the environmental vector receiving the highest release of 2309.6 g TEQ/a) and water the least (0.2 g TEQ/a).

Other notable observations from the inventories were that:

(1) Most of the POPs in the articles (electronics, car seats shoes, bags etc) end up in waste streams in the environment;

(2) There is limited public education about POPs, their potential health, environment effects and the socio-economic implications of mismanagement of these chemicals;

(3) There exist inadequate capacities of key institutions to soundly manage chemicals (POPs inclusive) throughout their life cycle;

(4) POPs contaminated sites in need of remediation exist in the country; and

(5) A continuous research and monitoring programme for POPs in Uganda's environment is lacking except for a few isolated cases of research work carried out.

From the socio-economic assessments, the health risks posed by exposure to POPs include health burden from cancers, underdevelopment of reproductive organs, the brains, thyroid glands and endocrine disruption, among others. Economic costs include potential loss of international markets where sanitary and phytosanitary concerns are stringent. Fisheries, horticultural exports, coffee, tea and other agricultural commodity exports could potentially be threatened.

An economic assessment of the cost of inaction indicated that Uganda could be losing a present value income of $17.3 million/year averaged over a five-year period starting in 2014. Similarly, the economic assessment of the cost of implementing some management options showed a cost of just under $2 million/year, which is less than one-fifth at an efficiency of 60% impact translating into about $ 10 million/year savings of national income. Therefore, undertaking management actions for controlling the POPs would be a viable undertaking with a net present value of averaging $8 million/year.

National priorities to address the issues identified

The priority areas under the revised NIP for Uganda are based on the findings of the national POPs inventory process, stakeholder priority setting, action planning and NIP development workshops held in 2015. The revised NIP identified and prioritised eight strategic areas of intervention, namely:

1. Phase out of use of Endosulfan as an agricultural pesticide and identification of cost effective alternatives.
2. Development of national awareness creation and educational programmes on the effects of POPs and other hazardous chemicals on human health and the environment.
3. Strengthening of the regulatory framework and institutional capacities for the management of POPs and other chemicals.
4. Reduction of emissions of PBDEs and PCBs through Environmentally Sound Management (ESM) of wastes in Electrical and Electronic Equipment (WEEE); End of Life Vehicles (ELVs) and PCB contaminated transformer oils and equipment.
5. Introduction of cleaner management practices for products, articles and wastes containing PFOS and other hazardous chemical wastes.
6. Reduction of emission of unintentionally produced POPs from dumpsites, open burning of wastes, metal production processes, waste incineration amongst others.
7. Enhancement of environmental monitoring programmes for POPs and other hazardous chemicals.
8. Introduction of environmentally sound management practices for sites and equipment contaminated by POPs.

It is therefore envisaged that this NIP for Uganda will be implemented through a multi-stakeholder approach, with emphasis on mainstreaming the proposed actions into the various sectoral plans and budgets. NEMA will continue to coordinate implementation of the NIP while seeking financial and technical support from local and international partners.

NIP implementation and financial requirements

This is a 10 year Action Plan, to be implemented, from 2016- 2025. The activities in the plan have been scheduled as, short-term (2016 – 2018), Medium term (2019-2021) and Long-term (2022-2025). The estimated financial requirements for implementation of the NIP add up to $ **50,730,332.86.**

Summarised strategic areas of invention, action areas and estimated budgets

Strategic Objectives	Action areas	Estimated budget (USD)
1. *To eliminate the use of endosulfan and promote adoption of cost-effective alternatives*.	(i) Apply for exemption for specific crop-pest complexes; (ii) Create targeted awareness on the phase out of endosulfan and phase in of alternatives (iii) Undertake regulatory action for phase out of importation and use of endosulfan in agriculture; (iv) Enforce compliance among importers and users of endosulfan (v) Identify, assess, adopt and promote cost effective alternatives to endosulfan (vi) Identify sites contaminated by endosulfan and establish ESM measures	**1,636,333.28**
2. *To raise national awareness and education and develop educational programmes on hazardous chemicals and waste, including POPs for key target stakeholders and the general public*	(i) Design and implement a targeted public education strategy for all relevant stakeholders (decision makers, policy makers, Local Governments, the private sector, CSOs, the formal education sector, the non-formal and informal sectors, community leaders, women and youth group associations etc.) (ii) Develop, and produce education and training materials on ESM of POPs for all relevant stakeholders, including training materials for use in the existing school curricula (i.e formal, non-formal and informal education sectors) (iii) Implement public education and training programmes for all relevant stakeholders, including institutions of higher education and communities; (iv) Establish a web-based portal on ESM of POPs and technology transfer.	**4,733,333.20**
3. *To strengthen the regulatory, institutional and policy frameworks for the management and monitoring of POPs and other chemicals*	(i) Finalise and operationalise regulations / legislations for ESM of POPs. (ii) Legally establish and operationalise a Multisectoral Technical Committee for Chemicals Management. (iii) Enhance capacities of key institutions and agencies in coordinating, monitoring, analysis and management of POPs. (iv) Develop sectoral policies for meantsreaming POPs issues in national plans development programmes, and or projects	**5,405,333.36**
4. *To reduce emission and releases of PBDEs and PCBs through ESM of wastes in electrical and electronic equipment (WEEE), end-of life vehicles (ELVs), and PCB contaminated equipments*	(i) Develop WEEE and ELVs management strategies including exploration of innovative business approaches such as PPP mechanism; (ii) Demonstrate BAT/BEP for ESM of whole lifecycle of WEEE in existing facilities and infrastructure; train relevant stakeholders and facility workers based on the Basel Convention ESM guidelines and other relevant guidances; (iii) Designate centers for WEEE segregation, storage and recycling/ recovery of valuable parts and develop disposal strategy for PBDEs containing wastes. (iv) Designate licensed yards for ELVs collection, dismantling, recovery of reusable parts selected and disposal strategies of related wastes developed; (v) Enhance capacity of Local Governments, formal and non-formal sectors to effectively ensure ESM of WEEE and ELVs. (vi) Eliminate the use of PCBs in electrical transformers by 2025;	**24,617,775.93**

Strategic Objectives	Action areas	Estimated budget (USD)
	(vii) Decommission all residual PCB electrical transformers by 2022 (viii) Establish interim storage facility for solid and liquid waste consisting of and/or contaminated with PCBs by 2017 (ix) Promote measures to reduce exposure and risks to PCB oils and PCB contaminated equipment.	
5. To *properly manage products, articles and wastes containing PFOS and other hazardous chemical wastes*	(i) Profile products containing PFOS (ii) Ensure proper management and disposal of articles and wastes containing PFOS (iii) Reduce risk arising from the importation of articles and products containing PFOS (iv) Improved management of the PFOS contained in Stocks of Fire Fighting Foams (FFF) (v) Remediate contaminated sites where FFF was applied in the past	**4,355,556.27**
6. *To reduce emissions and releases of UPOPs from major sources*	(i) Introduce BAT/BEP in municipal solid waste management to reduce emissions of UPOPS from open burning (ii) Introduce BAT/BEP for a cleaner management of medical waste (iii) Introduce BAT/BEP in ferrous and non-ferrous metal production.	
7. *To establish a research and monitoring programme for hazardous chemicals and waste, including POPs*	(i) Establish a programme for monitoring levels of POPs, hazardous chemicals and their transformation products in the environment in order to participate in the Global Monitoring Plan for effectiveness evaluation (Article 16) (ii) Enhance the laboratory capacity of participating partner institutions (iii) Design and implement the monitoring and compliance programme.	**1,333,333.36**
8.*To improve the management of POP-contaminated sites and equipment*	(i) Detailed assessment and analysis of identified contaminated sites (ii) Restoration and remediation of selected contaminated sites.	**436,666.68**
NIP management and Monitoring Costs	(i) Create a section within NEMA to manage NIP implementation (ii) Hold regulator stakeholder coordination meetings (iii) carry out periodical Internal reviews and evaluations (iv) Develop a Funding mobilization strategy (business plan) - organise a donor workshop (v) Communicate the progress of implementation of the NIP (vi) Carry out mid-term evaluation	**4,661,999.98**
Grand Total		**50,730,332.86**

CHAPTER ONE

1.0 INTRODUCTION

1.1 The Stockholm Convention and justification for review and update of the NIP

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global agreement that entered into force on 17th May 2004. The objective of the Convention is to protect human health and the environment from the adverse effects of POPs (Article 1). POPs are chemicals that remain intact in the environment for long periods of time, become widely distributed geographically, resist biodegradation, accumulate in the fatty tissue of humans and wildlife and have adverse effects on human health and the environment. Uganda ratified and acceded to the Convention on 20th July 2004, hence making it a party to it. By ratifying the Convention, Uganda agreed to the management and control of POPs through a series of specific measures. Thus, pursuant to Article 7 of the Convention, Uganda developed her first National Implementation Plan (NIP), with financial support from the Global Environment Facility (GEF), and transmitted it to Secretariat of the Convention in 2009.The first 12 POPs covered under the Convention and were the focus of the first NIP are: (i) **POPs pesticides:** Aldrin, Chlordane, Dieldrin, DDT, Heptachlor, Endrin, Mirex, Toxaphene and Hexachlorobenzene (HCB); (ii) **POPs industrial chemicals:** Hexachlorobenzene (HCB), & Polychlorinated biphenyls (PCBs); and (iii) **Unintentionally produced POPs:** HCB, PCBs, Polychlorinated dibenzo-p-dioxins and Poly chlorinated dibenzo furans (PCDD/PCDF-dioxins & furans).

At a Conference of Parties in 2009, the Convention text was amended to list nine new POPs and these are; **POPs pesticides:**(i) Lindane (ii) Chlordecone (iii) Alpha Hexachlorocyclohexane (alpha-HCH) (iv) Hexachlorocyclohexane (Beta-HCH) and (v) Pentachlorobenzene (PeCB) used as a chemical intermediate in the manufacture of Pentachloronitrobenzene (quintozene); **POPs industrial chemicals:**(vi)Tetrabromodiphenyl ether and Pentabromodiphenyl ether (commercial Penta-BDEs) (vii) hexabromodiphenyl ether and heptabromodiphenyl ether **(**commercial Octa-BDEs**)** (xiii) Hexabromobiphenyl (ix) Perfluorooctane sulfonic acid, its salts & perfluoro-octanesulfonyl fluoride (PFOS**)**. In in a similar Conference of the Parties (COP) in 2011, one additional POP Pesticide Endosulfan was added to Annex A of the Convention text for elimination; and in 2013 Hexabromocyclododecane (HBCD) was listed.

Following the addition of these new POPs, it was imperative that the parties review and update their NIPs. This is in conformity with Article 7 of the Stockholm Convention which oblige parties to review and update, as appropriate, their implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties.

Consequently, under the initial National Implementation Plan (NIP), the Government of Uganda received funds from the Global Environment Facility (GEF) Trust Fund to review and update the country on National Implementation Plan (NIP), aligning it to Stockholm Convention on Persistent Organic Pollutants (POPs). The funds were channelled through the United Nations Industrial Development Organisation (UNIDO) while the project was executed by the National Environment Management Authority (NEMA) on behalf of the Government of Uganda.

1.2 General information on POPs, Historical Perspectives and Documented Effects

1.2.1 General information on POPs

The POPs are organic compounds of natural or anthropogenic origins which, once released into the environment, remain intact for exceptionally long periods of time.

They are thermally and chemically stable, thus very resistant to biological degradation. POPs include; industrial chemicals, pesticides and by-products such as polychlorinated dioxins and furans. They bio-accumulate in the fatty tissues of living organisms, including humans and wildlife, and are found in higher concentrations at higher levels in the food chain. At high concentrations, they are toxic to both humans and wildlife. POPs are introduced to humans through the food chain. They can also be passed on from mother to child and are known to have significant negative immunological, neurological and reproductive health effects. POPs are semi-volatile chemicals that evaporate from the regions in which they are used and are then transported over long distances in the atmosphere and aquatic ecosystems. This results into widespread distribution of POPs across the globe, including regions where they have never been used.

Some POPs are also known to be **Endocrine disrupting Chemicals (EDCs)** as documented in, '*Global assessment of the state of the Science of Endocrine Disruptors -2012",* a publication jointly produced by WHO, UNEP and the international Labour Organisations. Endocrine disruptors are chemicals which interfere with hormonal chemical reactions in the body, usually by "mimicking" an existing hormone and inhibit the normal hormonal activities in the human and animal body. The chemical toxicant either binds with a hormone receptor or blocks the normal hormonal response (inhibition) or behaves like a body hormone by binding to the specific hormone receptor and triggers off a hormonal response out of proportion to the expected normal response.

Some of the POPs known to be EDCs, include PCBs, dioxins, DDT, some brominated flame retardants and perflourochemicals while some of the reported health effects of endocrine disruption include the following:

(i) Birth defects; Alterations in sexual development, such as structural abnormalities of the uterus, cervix, and reduced sperm count;
(ii) Genital malformations (e.g. undescended testis);
(iii) Thyroid gland dysfunction;
(iv) Endocrine–related cancers(breast, uterus, ovary, prostate, testicular, thyroid);
(v) Obesity;
(vi) Type 2 Diabetes;
(vii) Neurologic disorders, learning difficulties, decreased mental capacity;
(viii) Immunologic disorders;
(ix) Early puberty in young girls.

1.2.2 Historical Perspectives and Documented Effects of POPs

Table 1 : Historical Perspectives and Documented Effects of POPs

S/N	Pesticides as listed in the Annex of SC	Historical perspectives and documented effects
	Old POP Pesticides	
1	Aldrin (Annex A)	Pesticide widely used until the 1970s when it was banned in most countries. It was heavily used as a pesticide to treat seed and soil against termites, grasshoppers and rootworm. Humans are mostly exposed to Aldrin through dairy products and animal meat. • Aldrin is known to deform foetuses in pregnant women.

2	Chlordane (Annex A)	Pesticide widely used until the late 1980s when it was banned in most countries. It was an emulsified liquid or a dust. Before the ban, it was used on maize and citrus as a pesticide as well as a termiticide. It is believed that human exposure is mainly through air. a) Chlordane is linked to liver, kidney and blood disorders; disrupts the endocrine, cardiovascular, and reproductive systems.
3	DDT (Annex B)	DDT pesticide was widely used during World War II to protect soldiers and civilians from malaria and other diseases spread by insects. It was continually used to control insect pests especially on cotton. It was used in developed countries until the mid 70s, and continues to be used in some developing countries to control malaria. In Uganda, DDT was used in control of cotton pests in 1950s to 1970s. It was also used along the Victoria Nile and led to the eradication of *Simulium damnosum (MOH, 1995.*) Between 1959 and 1960 WHO conducted a pilot Malaria control project in western Uganda where DDT was used for indoor Residue Sprays (IRS) in spray dwelling houses and kraals. b) DDT is a probable human carcinogen; may cause tremors and disrupts the kidney, liver, and immune and nervous systems; may cause nausea, diarrhoea, eye, nose and throat irritation.
4	Dieldrin (Annex A)	Pesticide originally developed in the 1940s as an alternative to DDT to control termites and textile pests, dieldrin proved to be highly effective insecticide and was very widely used during the 1950s to early 1970s. c) Dieldrin: deforms foetuses in pregnant women.
5	Endrin (Annex A)	Pesticide developed in the 1950s and used widely until the mid 1970s as foliar spray on cotton and grains. It is used also to control rodents such as mice and moles in orchards. The primary route of exposure for the general human population is through food. • Endrin affects the central nervous system, liver.
6	Heptachlor (Annex A)	Pesticide developed in the 1950s and used until the early 1970s to kill soil insects (such as termites), cotton pests and termites, grasshoppers, and other crop pests and malaria carrying mosquitoes. Food is the major source of exposure for humans. d) Heptachlor reduces reproductive abilities of men and women; detected in breast milk.
7	HCB (Annex A)	Pesticide (Fungicide) developed in the 1940s and used until the mid-1960s to treat seed fungi that affect food crops. It was widely used to control wheat bunt. Food is the most prevalent source of human exposure. e) Hexachlorobenzene is a probable human carcinogen; exposure over a long period may result in liver, kidney, or thyroid cancer.
8	Mirex (Annex A)	Pesticide used from the 1950s until the mid-1970s mainly to control the fire ants and termites. The main route of exposure for humans is through meat, fish and wild game meat. • Mirex is a probable human carcinogen increases the risk of miscarriages and it is anti-androgenic.
9	Toxaphene (Annex A)	Pesticide that was used from the 1960s to treat cereal grains, fruits, and vegetables and mange in cattle until it was banned in the mid-1980s. f) Toxaphene is a probable human carcinogen; disrupts the functioning of the liver, lung, kidney, and nervous system; may cause death if ingested in large doses.
New POP pesticides		
10	Alpha-HCH (Annex A)	By product. Although the intentional use of alpha-HCH as an insecticide was phased out years ago, this chemical is still produced unintentionally during the manufacture of Lindane. For each tonne of Lindane product produced, around 6-10 tons of other isomers including alpha and beta HCH are created. Large stockpiles of alpha and beta-HCH are therefore present in the environment.
11	Beta HCH (Annex A)	By product in the manufacture of lindane HCH breaks down in the body to many other substances; these include various chlorophenols, some of which have toxic properties. • In humans, breathing toxic amounts of beta-HCH can result into blood disorders, dizziness, headaches, and possible changes in the levels of sex hormones in the blood. These effects have occurred in workers exposed to HCH vapours during pesticide manufacturing. • People who have swallowed large amounts have had seizures; while some have died.

		• All HCH isomers can produce liver and kidney effects. HCH isomers are changed by the body into other chemical products, some of which may be responsible for the harmful effects. • HCH is a probable human carcinogen, especially, following chronic exposure. • In women, HCH exposure has been linked to breast cancer and cancers of the reproductive tract.
12	Chlordecone (Kepone) (Annex A)	Pesticide developed in the mid-1950s and used until the mid-1970s .The main exposure route is through food. Chlordecone is no longer produced or used, but it has been used in various parts of the world for the control of a wide range of pests. Specifically, it has been used extensively in the tropics for the control of banana root borer. It has also been used as a fly larvicide, as a fungicide against apple scab and powdery mildew, to control the Colorado potato beetle, rust mite on non-bearing citrus, and potato and tobacco wireworm on gladioli and other plants. It is regarded as an effective insecticide against leaf-cutting insects, but less effective against sucking insects. Chlordecone has also been used in household products such as ant and roach traps. • Chlordecone is readily absorbed into the body and accumulates following prolonged exposure. The pesticide is both acutely and chronically toxic. Its adverse effects include neurotoxicity, immunotoxicity, reproductive, musculoskeletal and liver toxicity, and liver cancer. The International Agency for Research on Cancer has classified Chlordecone as a possible human carcinogen (IARC group 2B). Chlordecone is absorbed through inhalation, oral, and dermal routes of exposure.
13	Endosulfan (Annex A)	Pesticide (Insecticide) that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative • Endosulfan affects the central nervous system, preventing normal function. Hyperactivity, nausea, dizziness, headache, or convulsions have been observed in adults exposed to high doses. Severe poisoning may result in death. • Studies of the effects of Endosulfan on animals suggest that long-term exposure to Endosulfan can also damage the kidneys, testes, and liver and may possibly affect the body's ability to fight infection. However, it is not known if these effects also occur in humans. It is unknown whether Endosulfan can cause cancer in humans. Studies in animals have provided inconclusive results.
14	Lindane (Annex A)	Pesticide /pharmaceutical- used as an agricultural pesticide and as treatment for lice and scabies. Produced since 1950s until it was banned in most countries in 2006-2007. Lindane is persistent, bioaccumulates and bio concentrates rapidly. There is evidence for long-range transport and toxic effects in animals and aquatic organisms. Lindane's body burden is a significant concern given its effects on human health — especially the nervous system. Human exposure to lindane is linked to a number of health impacts: • *Neurological Effects:* Humans exposed accidentally to high levels of lindane have experienced seizures, convulsions, vertigo, and abnormal EEG patterns. • *Cancer:* Lindane is associated with elevated risks of non-Hodgkin's lymphoma, liver, and breast cancer • *Endocrine Disruption:* Lindane has been reported to interfere with the hormone levels of human males exposed to the insecticide. In laboratory studies, lindane mimics estrogen in female rats and mice. • *Reproductive Effects:* Lindane and other organochlorine pesticides have been detected in high levels in blood of pregnant women who miscarried or had pre-term babies. Lindane is also linked to reduced sperm counts, and decreased ovulation in animal studies (ATSDR). • *Immunological Effects:* Lindane is thought to impact the human immune system. Workers exposed to lindane experienced increased levels of antibodies in their blood. • *Liver Toxicity:* Exposure to lindane is linked to increased levels of liver enzymes, increased liver weight and liver toxicity.

Industrial POPs Chemicals

	Industrial POPs	Historical perspectives and documented effects
15.	Polychlorinated biphenyls (PCB) (Annex A, C)	Commercial PCBs are a mixture of 50 or more PCB congeners. PCB characteristics include fire resistance, low electrical conductivity, high resistance to thermal breakdown, high degree of chemical stability, and resistance to many oxidants and other chemicals and these useful physical and chemical properties led to their widespread uses. The main use of PCBs has been for insulation, added to transformers oils and capacitors. g) Acute exposures to high levels of PCBs have been associated with skin rashes, itching and burning, eye irritation, skin and fingernail pigmentation changes, disturbances in liver function and the immune system, irritation of the respiratory tract, headaches, dizziness, depression, memory loss, nervousness, fatigue, and impotence. h) Effects of frequent low-level PCB exposures reported include liver damage, reproductive and developmental effects, and possibly cancer. The US Department of Health and Human Services as well as the International Agency for Research on Cancer (IARC) consider PCBs to be probable carcinogens in humans. i) Recent studies indicate that PCBs are Endocrine disrupting chemicals.
16.	Hexabromobiphenyl (Fire Master) (Annex A)	Hexabromobiphenyl belongs to the group of polybrominated biphenyls, which are brominated hydrocarbons formed by substituting hydrogen with bromine in biphenyl. Hexabromobiphenyl is an industrial chemical that has been used as a flame retardant, mainly in the 1970s. According to available information, hexabromobiphenyl is no longer produced or used in most countries due to restrictions under national and international regulations. The chemical is highly persistent in the environment, highly bioaccumulative and has a strong potential for long-range environmental transport. It is classified as a possible human carcinogen and has other chronic toxic effects.
17.	Tetrabromodiphenyl ether and Pentabromodiphenyl ether (PBDEs) (Annex A)	Tetrabromodiphenyl ether and Pentabromodiphenyl ether are the main components of commercial Pentabromodiphenyl ether (Penta-BDE). They belong to a group of chemicals known as “polybromodiphenyl ethers” (PBDEs). The commercial mixture of Penta-BDE is highly persistent in the environment, bioaccumulative and has a potential for long-range environmental transport (it has been detected in humans throughout all regions). There is evidence of its toxic effects in wildlife, including mammals
18.	Hexabromodiphenyl ether and heptabromodiphenyl ether (PBDEs) (Annex A)	Hexabromodiphenyl ether and Heptabromodiphenyl ether are the main components of commercial Octabromodiphenyl ether (Octa-BDE). The commercial mixture of Octa-BDE is highly persistent, has a high potential for bioaccumulation and food-web biomagnification, as well as for long-range transport. The only degradation pathway is through debromination and producing other bromodiphenyl ethers. Health effects: • Recent concerns on possible adverse health effects of PBDEs are focusing on their potential endocrine disrupting effects and on developmental neurotoxicity. • Deficits in learning and memory. • Changes in motor activity and reactivity to the environment. • In male animal studies, marked decreases in sex steroid hormones and decreased anogenital distance (a marker of estrogenization). • Also, increased sweet preference in males, a marker of feminization for this sexually dimorphic behaviour. • Decreased sperm production, sperm counts, and sperm head deformities. Dose related decreases in epididymis, seminal vesicle, and prostate weight. • In female animal studies , delay in puberty, decreased ovarian follicles

19.	Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F) (Annex B)	PFOS is a fully fluorinated anion, which is commonly used as a salt or incorporated into larger polymers. PFOS and its closely related compounds, which may contain PFOS impurities or substances that can result in PFOS, are members of the large family of perfluoroalkyl sulfonate substances. PFOS is extremely persistent and has substantial bioaccumulations and biomagnifying properties, although it does not follow the classic pattern of other POPs by partitioning into fatty tissues, but instead binds to proteins in the blood and the liver. It has a capacity to undergo long-range transport and also fulfills the toxicity criteria of the Stockholm Convention. PFOS is both intentionally produced and an unintended degradation product of related anthropogenic chemicals. The current intentional use of PFOS is widespread and includes: electric and electronic parts, firefighting foam, photo imaging, hydraulic fluids and textiles. PFOS is still produced in several countries. Epidemiology studies suggest associated health problems to include: increased incidence of pregnancy-induced hypertension, increased total cholesterol in adults, odds ratio for thyroid disease in children (1-17 years), • increased hazard ratio for thyroid disease in adult men, • decreased influenza antibodies in adults greater than 18, • increased risk of ulcerative colitis, • increased risk of kidney and testicular cancer, • increased incidence of thyroid disease in adult women, • decreased sperm levels and increased reproductive hormone levels in men born to mothers with higher in utero PFOA serum levels. PFOA and PFOS have a half-life in humans ranging from two to nine years. Continued exposure can increase body burdens that would result in adverse outcomes.
	Unintentional POPs Polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/PCDF) Hexachlorobenzene (HCB) Pentachlorobenzene (PeCB) (Annex C)	Reasonably suspected to cause cancer, red skin rashes, excessive body hair; changes in blood and urine that signal liver damage.

1.3 NIP development methodology

The process of developing the NIP started in June 2014 under the project entitled *"Enabling Activities to review and update the NIP for the SC on POPs"* with funding from Global Environment Facility (GEF). It consisted of five major steps, namely;

1) Establishment of a coordination mechanism and process organizations.
2) Establishment of POPs inventories and assessment of national infrastructure.
3) Prioritization of action plans and objective setting.
4) Formulation of the NIP.
5) Endorsement by stakeholders and government.

The development process was undertaken by stakeholders drawn from government departments, research and academic institutions, private sector and Civil Society Organizations (CSOs). The Government of Uganda designated National Environment Management Authority (NEMA) as the National Executing Agency (NEA) which in turn established a Project Coordination Unit (PCU) and a Multi-sectoral Coordination Committee (MCC) to oversee the implementation of the project. An international expert was hired by UNIDO to assist in inventory training, reviewing the inventory reports and providing specific comments to further improve on the various documents. The international consultant also guided the formulation of the NIP document.

The inventory exercise was carried out by seven task teams in the following aspects:

1) Inventories of Old and New POPs Pesticides;
2) Assessment of socio-economic implications of use and reduction of New POPS;
3) Legislative, Regulatory and Institutional framework for new POPs management;
4) Inventory and quantification of Unintentionally Produced Persistent Organic Pollutants (UPOPs);
5) Inventories of New Industrial POPs: Perflouroctane Sulfonic acid (PFOS), its salts and Perflouroctane Sulfonyl Fluoride (PFOS-F);
6) Review and update of Old Industrial POPs: Hexachlorobenzene (HCB) and Polychlorinated biphenyls (PCBs);
7) Inventories of New Industrial POPs: Hexabromobiphenyl (HBB)and the PolyBrominated Diphenyl ethers (PBDEs) ;

The seven consultancy teams for the inventories carried out public consultations with those potentially affected by the production, use and management of the POPs such as business community groups, agricultural groups, women and children. This information was assessed to provide a basis for inventory reports and designing of action plans in this NIP document.

1.4 NIP Structure

This NIP document was prepared in line with UNEP, '*Guidance for Developing, a National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants, 2012'.* The NIP is divided into Three Chapters:

Chapter One outlines the purpose and structure of the NIP, including a summary of the Stockholm Convention, its aims, and obligations. It describes the NIP development methodology and NIP Structure, provides a summary of the POPs issues, that is, the background to the chemicals, their uses, and the problems they cause. Briefly chapter one also covers the progress to date in implementing the Convention in Uganda.

Chapter Two provides the country baseline including a description of the current situation and state of knowledge in the country about POPs and the status of institutional capacity to address the problem. The chapter links the NIP to other national development frameworks and also provides a review of the policy and legislative framework for the management of POPs in Uganda. The chapter also describes the country's profile, summarizing information on geography and population, membership in regional and subregional organizations, 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. All POPs assessments of carried out are included in this chapter including existing programmes for monitoring releases and environmental and human health impacts, information on the state of knowledge on stockpiles, contaminated sites and wastes, among others.

Chapter Three, has two elements: a formal policy statement and the implementation strategy for the NIP. The implementation strategy presents specific action plans or strategies to achieve Convention obligations and in line with the National Development Plan (NDP-II) objectives for chemicals management in the country.

CHAPTER TWO

2.0 COUNTRY BASELINE

2.1 Country Profile

2.1.1 Physical and Climatic Description

Figure 1: Map of Uganda (http://www.stuartford.me.uk)

Uganda is a land locked country with an area of 241,500 km^2 lying astride the equator. It is located in the eastern region of Africa, situated between latitudes 1º 30' south and 4º North and longitudes 29º 30' East and 35º East (Figure 1). The country is bordered by Kenya to the east, Tanzania and Rwanda to the south, the Democratic Republic of Congo to the west and South Sudan to the north. Of the total surface area of Uganda, about 10.9% is open water, 2.4 % permanent wetlands and 8.5% seasonal wetlands.

The main topographical features of the country include a high plateau modified by eroded volcanic mountains in the northern eastern and western borderlands. The Rwenzori and Mufumbira volcanic mountains are part of the western rift valley, which continues to Tanzania. Generally, the country's climate is classified as humid with a steady sunshine regime all year round, only modified by cloud cover during rainy seasons. Temperatures average 21^0C ranging between 16^0C the 27^0C. Annual rainfall varies from 500 mm in the East to 2000 mm around Lake Victoria and the mountains. Rainfall is moderately reliable, is bimodal in the South and unimodal moving towards the Northern border.

The hydrology of Uganda is dominated by the drainage system of Lake Victoria. Lake Victoria, the largest freshwater lake in Africa, has a surface area of about 68,800 km^2 and a watershed area of about 195000km^2. The lake is a trans-boundary water resource shared by the East African countries of Kenya, Uganda and Tanzania, supporting over 30million people in its watershed. The largest watershed drainage into Lake Victoria is from Tanzania followed by Kenya, Uganda contributing the smallest. The largest contributor of the lake's water is precipitation (rainfall) which is equally offset by evaporation. The net outflow of the lakes water is largely due to the River Nile which flows through Lakes Kyoga and Albert basins to Sudan, Egypt and into the Mediterranean Sea thus being the longest river in Africa. River Nile is the source of livelihood to millions of people whose countries are transversed by the Nile River. Other major lakes include Lakes George, Edward, Kyoga and Albert among others.

2.1.2 Political Governance

Uganda is a republic governed under the multi-party democracy system with three arms of government namely; the executive, parliament and the judiciary. In addition the country operates a local government system under the Decentralization Policy Framework. The lower administrative units for example counties, sub counties, parishes and villages or Local Council (LC1) are democratically elected.

2.1.3 Languages and Religion

English is the official language and the major medium of formal instruction in the Ugandan education system. Swahili is the national language and the official language for the East African Community. There are over 70 ethnic languages/dialects in Uganda. In Uganda there is freedom of worship and religious congregation.

2.1.4 Demography

Based on the 2014 Census and projections, between 2002 and 2014, the population increased from 24.2 million to 34.9 million. This gives an average annual growth rate of 3.03%. At this rate of growth, the population of Uganda was projected to increase to 35.0 million in 2015 and further to 47.4 million in 2025. The current age and gender distribution is as follows;
0-14 years: 48.7% (male 8,714,354/female 8,765,900)
15-24 years: 21.2% (male 3,775,679/female 3,833,574)
25-54 years: 25.7% (male 4,618,088/female 4,615,616)
55-64 years: 2.4% (male 405,740/female 447,118)

65 years and over: 2.1% (male 327,771/female 415,075)

Life expectancy is estimated at 53 years for men and 56 for women. The fertility rate has stagnated at 6 children born per woman. Adult literacy rates are 64.6% for women and 82.6% for men.

2.1.5 Economic Development

The past two decades have seen the Ugandan economy go through an expansive phase of sustained economic growth, with Gross Domestic Product (GDP) growing at an average annual rate of 7.1% from 1992 to 2011, the third highest growth rate recorded in Sub-Saharan Africa during this period, only surpassed by Equatorial Guinea (20.1%) and Liberia (9.8%). This strong economic performance has been driven by growth in the industrial, and services sectors (with value added for these activities growing at an average of 9.9% and 8.1% between 1992 and 2011) and has been underpinned by strong investment and export growth (with gross fixed capital formation growing on average by 8.6% per year during this period and export of goods and services growth by 17.2%). This prolonged phase of economic growth has benefitted from a period of relative macroeconomic and political stability, especially since the end of the armed conflict in Northern Uganda in the mid-2000s. Growth has also been bolstered by large inflows of Official Development Assistance (ODA), averaging 14.7% of *Gross National Income* (GNI) from 1991 to 2010, as well as by a general policy of openness to both foreign investment and international trade.

2.1.6 Membership to Regional Blocks

Uganda is a member of the East African Community, together with Kenya, Tanzania and more recently Rwanda and Burundi. It's also a member of the African Union, the Common Market for East and Central Africa (COMESA), the International Conference on the Great Lakes Region (ICGLR), Nile Basin Initiative (NBI) and the Inter - Governmental Authority on Development (IGAD).

2.1.7 NIP Consistency with Vision 2040 and National Development Plan (NDPII) targets

Uganda Vision 2040 provides development paths and strategies to operationalize Uganda's Vision statement which is "A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years" as approved by Cabinet in 2007. It builds on the progress that has been made in addressing the strategic bottlenecks that have constrained Uganda's socio-economic development since independence. It is implemented in line with the comprehensive National Development Planning Framework. Interventions are sequenced and detailed in the 5-year national development plans and annual budgets.

The National Development Plan (NDPII) is the second in a series of six 5-year Plans aimed at achieving Uganda Vision 2040. The goal of this plan is to propel the country into middle income status by 2020 with a per capita income of USD1, 033. The NDPII major objective is "*to promote and ensure the rational and sustainable utilization, development and effective management of the environment and natural resources for socio-economic development of the country*". This will be realised through strengthening the country's competitiveness for sustainable wealth creation, employment and inclusive growth.

Under the Environment and Natural Resources (ENR) sector of the NDPII, government has prioritised electronic and other hazardous waste management and sound management of chemicals, through their life cycle, targeting;

i. establishment of sanitary waste management facilities;

ii. establishment regional centres for e-waste management;
iii. promotion of innovations in clean and environmentally sound technologies for waste management;
iv. establishment of regional poison /emergence response centres;
v. development of policy, legal and institutional arrangements for chemicals management;
vi. creating a program for sound management of consumer and industrial chemicals.

As the country intensifies the drive for modernisation of agriculture, industrialisation and infrastructure development, Oil and Gas development, development in the mining industry, integration of ICTs, POPs, emerging POPs and UPOPs are likely be on the rise. It is, therefore, necessary to have a sound plan and capacity for their management and monitoring. Its against this background that this NIP was developed.

2.2 Institutional and Legislative Framework for POPs Management

2.2.1 Policy Framework for POPs Management

There are several sectoral policies addressing chemicals and environment management in Uganda. Currently the country's policy framework does not adequately address concerns on POPs management. The few policies reviewed and found broadly relevant to POPs management include the Environment Health Policy, the National Oil and Gas Policy, the National Agricultural Policy 2013, the National Agricultural Research (NAR) Policy 2003, the National Policy on Injection Safety and Health Care Waste Management 2004, the Policy and Strategy for Indoor Residual Spraying 2006, the National Health Policy 1999, the National Trade Policy 2007, the National Environment Management Policy (NEMP) 1994, the Plan for Modernization of Agriculture (PMA), the Poverty Eradication Action Plan (PEAP) and the National Development Plan (NDP).

In appreciation of the weak integration of POPs in the existing policy frameworks, strategies for management of POPs and other hazardous chemicals have been integrated into the draft NEMP 2015.

2.2.2 Legislative and Regulatory Framework

The Constitution of the Republic of Uganda, 1995 provides for a right to a clean and healthy environment under Article 39. Additionally, Article 245 empowers Parliament to make laws providing for measures intended to protect and preserve the environment from abuse, pollution and degradation, to manage the environment for sustainable development and to promote environmental awareness. These provisions are in line with the Stockholm Convention objective of protecting human health and environment from POPs.

To give effect to the Constitutional provision, Parliament has enacted several laws to protect the environment and human life including:

(i) The National Environment Act, Cap 153;
(ii) The Agricultural Chemicals Control Board, Act, 2006 and the Control of Agricultural Chemicals (Registration and Control) Regulations (*in draft*);
(iii) Food and Drugs Act, Cap. 278;
(iv) The National Drug Policy and Authority Act, Cap. 206
(v) Water Act, Cap. 152;
(vi) The Public Health Act Cap. 281;
(vii) The Occupational Safety and Health Act No. 9, 2006
(viii) Access to Information Act No. 6 of 2005;

(ix) External Trade Act, Cap 88;
(x) Uganda National Bureau of Standards Act, Cap 327;
(xi) The Industrial Licensing Act, Cap 91; and,
(xii) The Local Governments Act, Cap 243; amongst others.

To address the deficiency in the national laws, regulation of production, transportation, use and disposal of articles containing POPs is done under international legal instruments.

However, the existing gaps in the laws have been addressed under the review of the National Environment Act, Cap.153, and the current draft NEA Bill 2015 provides for a multi-stakeholder coordinating mechanism to link the various stakeholder agencies and entities that handle the different aspects of POPs chemicals throughout their lifecycle.

2.2.3 Institutional framework for POPs Management

The management of chemicals generally and POPs in particular is shared among different government ministries, departments and agencies (MDAs) and coordinated by NEMA. The key institutions relevant for POPs management in the country include: Ministry of Water and Environment (MoWE); NEMA; Ministry of Agriculture, Animal Industry and Fisheries (MAAIF); Ministry of Health (MoH); Ministry of Gender, Labour and Social Development (Directorate of Labour Employment and Occupational Safety); Ministry of Trade, Industry and Cooperatives [(Uganda National Bureau of Standards(UNBS); Uganda Industrial Research Institute (UIRI); Uganda Export Promotions Board (UEPB); Uganda Cleaner Production Centre (UCPC); Ministry of Internal Affairs (Directorate of Government Analytical Laboratory; Uganda Police Force (UPF) of the Ministry of Internal Affairs, Ministry of Education, Science, Technology and sports(MoESTS); academic institutions; Ministry of Foreign Affairs(MFA); Ministry of Finance, Planning and Economic Development(MFPED); Customs Department of Uganda Revenue Authority; and Ministry of Justice and Constitutional Affairs (MJOA).

All the listed MDAs have important roles to play in POPs management in Uganda, however, lack of technical and infrastructural capacities and lack of coordinated efforts were some of gaps identified during institutional assessment. These MDAs liaise with CSOs (to create awareness on POPs) and the private sector (to handle POPs and chemicals in general). However, some of the CSOs lack technical capacity and resources to adequately support the management of POPs.

2.2.4 Other International, Regional and Sub-regional Agreements

Uganda has ratified a number of other international and regional multilateral environment agreements (MEA's), among them: the Montreal Protocol on Ozone depleting substances; the Convention on Biological Diversity and related Protocol; the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes; the Rotterdam Convention on Prior Informed Consent (PIC) Procedure in international trade on certain hazardous Chemicals and Pesticides; the Bamako Convention, Minimata Mercury Convention and Strategic Approach to International Chemicals Management (SAICM) , and East African Protocol on Environment, amongst others.

2.3 Assessment of the POPs issue in the country

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

The assessment of POPs pesticides (Annex A, Part I chemicals) was based on the following parameters: historical, current, use, import; existing policy and regulatory frame work; summary of available monitoring data (environment, food, humans) and health impacts. The inventory focused mainly on the newly listed POPs Pesticides, namely, endosulfan.

2.3.1.1 History of POP Pesticides use in Uganda

a) DDT

In Uganda, DDT was used for control of cotton pests in 1950s to 1970s. It was also used in households to control post-harvest pests on beans, groundnuts or maize. DDT use in agriculture was banned in the early 1990s. DDT was also used along the Victoria Nile and led to the eradication of *Simulium damnosum (MOH, 1995)*. Between 1959 and 1960 WHO conducted a pilot Malaria control project in Western Uganda where DDT was used for IRS by WHO. DDT was also used for the control of lice and flees infestations.

In 2006, DDT was reintroduced in Uganda for malaria vector control with guidance from WHO. Government (MOH) received support from the President's Malaria Initiative (PMI) and IRS spraying using DDT was done in Apac and Oyam Districts (April-May 2008). After the first rounds of spraying, DDT use was discontinued. The balance of the chemical that was not used was shipped back to South Africa and since then DDT has not been used in Uganda

b) Dieldrin

Dieldrin in its formulation of Dieldrex was the insecticide of choice for the control of Tsetse flies through ground spraying of the tsetse habitat. Ground Spraying units were distributed throughout the country.

UNDP funded a Tsetse fly Control Project in 1987 which sprayed approximately 150 km^2 with dieldrin. In order to comply with the provisions of Stockholm Convention, the project was stopped and the remaining stock of 50,000 litres of dieldrin was shipped back to the United Kingdom for safe disposal.

c) Toxaphene

Toxaphene was one of the acaricides used on livestock in the cattle corridor districts of Uganda to control ticks. Prior to the use of toxaphene, there had been high abundance of the Yellow Billed Oxpecker (*Buphagus africanus*) birds which symbiotically coexisted with the livestock. Following the application of toxaphene, a significant decline in the number of these birds was observed. The current populations of the birds are predominant in the national parks where no acaricides were used.

d) Aldrin

In the 1950s Aldrin was used as a soil insecticide to control rootworms, beetles and termites. The pestcide is no longer used in the country. During inventorying 500g of aldrin was found in the stores of the National Forestry Research Institute (NaFORRI) in Kampala as an obsolete pesticide.

e) Lindane

The only reported use of lindane was on the former Uganda Seed Project in both Masindi and Kasese districts as a fungicide for seed dressing (mainly maize, beans, sorghum and millet) from late 1980s to around 2003 (Personal communication –Muyenzi John-Seed Factory Manager –Masindi, 2007). The pesticide is no longer used in the country.

f) Endosulfan

Endosulfan has been used as an insecticide in Uganda since early 1960s for control of sucking, chewing, boring insects and mites in a wide range of crops e.g cotton, coffee, maize etc. In addition, endosulfan was used for aerial spraying against tsetse flies in various parts of the country.

Currently, two formulations of endosulfan are registered in Uganda for crop pest control, i.e., Thionex 35 EC (Endosulfan 350g/l) and Endocel 35EC (Endosulfan 350 g/l).

These two products have been mainly used for;

i. Control of boring pests in coffee (Coffee Berry Borer, Coffee Twig Borer, Coffee Stem Borer)
ii. Control of cotton bollworm
iii. General spraying in green houses prior to planting mainly hot pepper and tomatoes (Personal communication from Balton Agronomist).

The latest inventory in December, 2014 showed that the total quantity of endosulfan (Thionex 35 EC) in stock was 11,806litres in one-litre packaging, with the highest quantity stocked by Balton (U) Ltd (11,480 litres). Though endosulfan is still legally registered there is a move by government to phase it out in the next five years.

2.3.1.2 Chemical and non-chemical alternatives to POP pesticides

There are initiatives in the country to identify possible chemical and non-chemical alternatives to POP pesticides. Through research several chemical alternatives to endosulfan have been recommended including**;**

(i) Vajra 05 EC (Lambda Cyhalothrin) 500ml/ha ;
(ii) Legend 10 EC (Alpha Cypermethrin) 300ml/ha;
(iii) Decis 2.5 EC (Deltamethrin)500ml/ha;
(iv) Decitab 2.5 (Deltamethrin)10 tabs/ha;
(v) Keshet 2.5 EC (Deltamethrin)500ml/ha;
(vi) Bull dock 025 EC (Beta Cyfluthrin)300ml/ha;
(vii) Amdoc Sc effective at 1.5lts/ha against yellow tea mites and red spider mites;
(viii) Engeo 247 SC (Lambda Cyxalothrin 106g/L + Thiametoxam 141g/L). Recommended rate is 200ml/ha;
(ix) Aster extrim 20Sl effective against bollworms, aphids, thrips, lygus bugs, leaf roller and leaf miner at 1lt/ha;
(x) Agrolambacin Sc at 1.2lts/ha;
(xi) Karate at 1.5lt/ha;
(xii) Profenofos 500 EC- 1lt/ha; and
(xiii) Chlorpyrifos 40EC- 1lt/ha.

The non-chemical alternatives that are recommended for use in Uganda are rooted into Integrated Pest Management (IPM) practices and include:

a) Inter-cropping *Hibscus* spp. (local *Malakwanga*) with cotton against insect pests;
b) intercropping cotton with cereals against Bollworms and *Lygus* bugs;
c) Biological control of pests using black ants, ladybird beetles and lace-wings and other predators;
d) Application of red pepper, cow urine, wood ash and a combination of the three against termites;
e) Use of odour- baited tsetse fly traps and targets;

f) Live- bait technology-where livestock treated with pesticides act as mobile targets for the pests;
g) Sterile Insect Technique;
h) Carrying out rotational grazing to break life cycles of external parasites like ticks;
i) Practice of perimeter fencing and paddock separation with herbs containing pesticides / repellent odours;
j) Carry out manual removal of external parasites like ticks; and
k) Encouraging farmers to promote indigenous breeds that are adapted to the local farming environments.

Some natural pesticides have also been recommended based on local experience and these include;

- Nimbecidine at 2lts/ha effective against bollworms, aphids, stainers and Lygus bugs;
- Kaya at 1.5lts/ha effective against bollworms; and,
- Talstar at 2.5lts/ha effective against bollworm, lygus bugs, stainers ,aphids

2.3.1.3 Institutional and Legal Framework for Pesticides Management

The Agricultural Chemicals (Control) Act, 2006 mandates the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in collaboration with other lead agencies to oversee the following:

a) Registration of agricultural chemicals for sale and use in the country;
b) Registration of premises for selling agricultural chemicals;
c) Registration of fumigators and commercial applicators, dealers, stockists;
d) Labeling , packaging and transportation;
e) Advertising and marketing;
f) Storage, use and safety (disposal and environment);
g) Records, returns and publication; and
h) Enforcement and other control measures.

Implementation under MAAIF is led by the Department of Crop Protection, as a secretariat, through an Agricultural Chemicals Board (ACB) appointed by the Minister. The ACB is assisted by the Agricultural Chemicals Control Technical Committee (ACCTC).

2.3.2 Assessment of Polychlorinated Biphenyls (PCB) (Annex A, Part II chemicals)

2.3.2.1 Stockholm Convention provisions

Polychlorinated biphenyls (PCBs) are aromatic compounds in which the hydrogen atoms on the biphenyl molecule are replaced by chlorine atoms. PCBs include 12 congeners for which the WHO has assigned toxicity equivalency factors because they exhibit dioxin-like toxicity (Green facts, 2004). PCBs have excellent dielectric properties, non-flammability and resistance to thermal and chemical degradation. For this reason, prior to national bans, they were manufactured for use in electrical equipment, heat exchangers, hydraulic systems and several other specialized applications. The Stockholm Convention differentiates between two categories of PCBs: (a) Intentionally produced PCBs whose production and use is to be eliminated and, as wastes, are to be managed and disposed of in an environmentally sound manner in accordance with the provisions of Articles 3 and 6 and Annex A; and (b) Unintentionally produced PCBs, for which parties are required to take specified measures to reduce their releases derived from anthropogenic sources.

According to Annex A Part II of the Stockholm Convention Each Party shall:

a) With regard to the elimination of the use of polychlorinated biphenyls in equipment by 2025: (i) Make determined efforts to identify, label and remove from use, equipment containing greater than 10 percent polychlorinated biphenyls and volumes greater than 5 litres; (ii) Make determined efforts to identify, label and remove from use, equipment containing greater than 0.05 percent polychlorinated biphenyls and volumes greater than 5 litres; and (iii) Endeavour to identify and remove from use equipment containing greater than 0.005 percent polychlorinated biphenyls and volumes greater than 0.05 litres;

Additional measures include:

b) Promote the following measures to reduce exposures and risk to control the use of polychlorinated biphenyls: (i) Use only in intact and non-leaking equipment and only in areas where the risk from environmental release can be minimised and quickly remedied; (ii) Not use in equipment in areas associated with the production or processing of food or feed; (iii) When used in populated areas, including schools and hospitals, all reasonable measures to protect from electrical failure which could result in a fire, and regular inspection of equipment for leaks;

c) Except for maintenance and servicing operations, not allow recovery for the purpose of reuse in other equipment of liquids with polychlorinated biphenyls content above 0.005 per cent;

d) Make determined efforts designed to lead to environmentally sound waste management of liquids containing polychlorinated biphenyls and equipment contaminated with polychlorinated biphenyls having a polychlorinated biphenyls content above 0.005 percent as soon as possible but no later than 2028, subject to review by the Conference of the Parties;

e) Endeavour to identify other articles containing more than 0.005 percent polychlorinated biphenyls;

f) Provide a report every five years on progress in eliminating polychlorinated biphenyls and submit it to the Conference of the Parties.

2.3.2.2 Status of PCBs in Uganda from the inventory of 2007 inventory

As of 2007, Uganda had an estimated 7115 transformers; however, only 160[1] were sampled, as follows: 52 from the Western Region, 4 from the northern region, 24 from the western region and 80 samples from Central. The samples were analysed for PCBs at the NEMA laboratory using the L2000 DX analyser. 12.5% of the samples were found to have PCB levels beyond the recommended threshold i.e. 50 ppm.

Since the early 1990s, the country has not imported PCB contaminated transformers. The inventory identified the following likely sources of the PCBs: cross-contamination with PCB-contaminated oil during service and repair of transformers; PCB-containing transformers manufactured before 1985, which are still in use; accidental spillage and leaks from old PCB-contaminated equipment; stolen transformer oil within the electricity distribution network, which is then reportedly used for welding, as a lubricant, cutting oil amongst others.

Currently most companies import PCB-free transformers and other electrical equipment and dielectric fluids. This is significant progress achieved since the 2007 PCB inventory, when PCB-containing oil was recorded in some parts of the country.

The total numbers of transformers (generation, transmission and distribution) in Uganda are estimated to be 12,169, distributed among the different companies as detailed in Table 2 below:

Table 2: Number of Transformers among Electrical Companies

No	Name of Operating Company	Use	Estimated Number
1	Uganda Electricity Transmission company	Transmission	55
2	Uganda Electricity Generation Company	Generation	40
4	UMEME Uganda Limited	Distribution	9,074
5	Rural Electrification Agency	Generation, Transmission	3000
	Total		12,169

UMEME has the largest stock of transformers (9,074) on its distribution network, 4,472 of which have been completely drained, refilled with PCB safe oil and affixed with PCB–safe tags. Rural Electrification Agency (REA) holds the second position with 3,000 operational transformers, they are all PCB free. The total number of capacitors was 42. These were mostly used for voltage regulation in transmission substations.

Currently transformers that have reached their end of life are informally managed as many of them are seen piled as scrap in Kisenyi area, downtown Kampala. However, it is difficult to estimate the number of contaminated electrical equipment that will reach their end of life annually. This is because the transformer database in Uganda does not show the dates when the transformers were installed or put into operation. The respective weights of transformer equipment and oils are also not included in the transformer database. The database shows only quarterly quantity of transformers in operation and the sizes based on KVA (5, 15, 16, 25, 50, 63, 100,150, 200, 250, 300, 315, 400, 500, 600, 630, 750, 800, 1000 and above). *Source: ERA Comprehensive Electricity Supply Industry Database.*

[1] Logistical problems of break-down of PCB testing equipment and the time restrictions limited the sample size of transformers used.

When a transformer has reached its end of life, it is automatically replaced with a transformer containing PCB-free mineral oil. This is because all companies are required to procure only PCB-free equipment. Since the average life span of a transformer is 30 years, the operating transformer will reach its end of life after the 30th year of operation.

The weights of transformers in Uganda vary as follows upon decommissioning.

1. The dry weight of transmission transformer is 58 tones; the liquid weight 23 tonnes.
2. Distribution transformer range from 150kg to 1.5 tonne dry weight, while liquid weight varies from 80kg to 700kg.

2.3.2.3 Potential risks from PCBs

The risk of PCBs to the country will be based on whether or not PCBs are managed and eventually eliminated by 2025. Two scenarios are considered:

The Status Quo scenario - where PCBs are neither managed nor eliminated by 2025 and *The NIP* scenario - where PCBs are managed as proposed in the NIP i.e. to be eliminated by 2025 .

The factors that influence the presence and therefore the potential future risk of PCB include: (i) the electrification rate; (ii) population growth rate; (iii) number of PCB-contaminated transformers in existence; and (iv) the rate of increase in transformers in the country. Currently, the electrification rate is estimated at 8 percent and it is envisaged to stay at this level between 2008 and 2025 (MEMD, 2006). At this rate, 10 percent of Uganda's population will have access to electricity by 2025, equivalent to an increase from 1.4 to 5.2 million people, respectively (*Table 3*).

Table 3: Projected electrification rate and transformer distribution, 2008 to 2025

Description of indicators	2008	2025
Electrification rate (%)	8*	8
Uganda's population (million)	28 *	53
Number of transformers	7,115**	26,326
Number of distribution transformers	7,000**	25,900
People with access to electricity (million)	1.4	5.2
Percentage of populations (%)	5	≃ 10

*Source: (adapted from UBOS 2006; **Source: (adapted from NEMA, 2007)

Under the *Status Quo*, the population that is likely to be most at risk from PCBs in Uganda is estimated to range between 17,640 and 141,120 between 2008 and 2025 (*Table 4*) i.e. about 10 per cent of the population that is being served with electricity. On the other hand, the NIP scenario envisages that the risk will disappear (zero) by 2025.

Table 4: Accumulation of PCBs over the years from cross contamination

Years	Likely PCB contaminated** Transformers	Population* served	Population most at risk (leaks) X PCB contaminated)
2008 – 2012	882	176,400	17,640
2013 – 2017	1764	352,800	35,280
2018 – 2022	3528	705,600	70,560
2023 - 2025	7056	1,411,200	141,120

*Source: (adapted from *UBOS 2006; **NEMA, 2007)*

Trends indicate that Uganda has fairly low level of urbanisation. However, this is likely to grow as the population of the country grows. By 2002, 12.3 percent of Uganda's population lived in urban areas, and this was growing at a rate of 5.1 percent. Most of the people at risk due to their proximity to transformers, that could potentially carry PCBs, are the urban residents.

Uganda's urban population is expected to be about 12.3 percent of the national population, by 2008, the percentage of the urban population will grow to 28.6 percent by 2025. The actual population likely to be exposed under the *Status Quo* scenario is 40,360 people by 2025 (*Table 5*.

Table 5: Population exposed to PCBs

Years	Population most at risk (12.6% (leaks) X 8% (% PCB contaminated) = 10%)	% of population	Urban population most at risk
2008 – 2012	17,640	13.6	2,397
2013 – 2017	35,280	17.4	6,139
2018 – 2022	70,560	22.1	15,594
2023 - 2025	141,120	28.6	40,360

Source: Uganda Population Secretariat (2007)

2.3.2.4 Measures / strategies for managing PCBs

Harmonisation of environment laws for management of priority hazardous wastes was identified among the first line of actions needed for managing PCBs. This also includes measures to ensure that: all PCB transformers are marked showing the PCB content; all transformers are leak proof; and PCB transformer station and storage sites that contain above 45 ppm of PCBs are licensed.

Two more recommended actions include

- Establishment of a properly managed storage facility.
- Use of appropriate containers for storage of PCBs.

The following are the summary of the proposed strategies for PCB management:

(i) There is need to create awareness and education on the dangers of PCBs;

(ii) There is need to build capacity for PCB waste generation companies to properly manage PCB contaminated equipment and waste;

(iii) Service companies should identify PCB-containing transformers at the point of reception;

(iv) Service companies should comply with the national laws to ensure the protection of human health and the environment;

(v) Electricity and private companies should have data bases of PCB containing equipment in their networks;

(vi) Electricity and private companies should manage wastes associated with PCBs in an environmentally sound manner. Potential leaks of PCBs from NEMA licensed waste operators should be addressed;

(vii) PCB waste generators should be assisted to properly manage the waste; and,

(viii) Purchase/ Sale Environmental and Social Audits at the time of change of ownerships of industrial facilities should be mandatory.

2.3.3 Assessment of POP-PBDEs (Annex A, Part IV and Part V chemicals) and HBB (Annex A, Part I) chemicals

The data collection on PBDES followed a three-tiered approach as recommended in the Guidance document, that is:

i. **Initial assessment**
   This involved data collection and interviews from identified stakeholders and sectors.
ii. **Preliminary inventory**
   This comprised surveys and site visits to better estimate the national data from selected stakeholders. This involved the use of questionnaires as outlined in the Guidance Document and interviews.
iii. **In-depth inventory**
   This involved the detailed assessment of the site and involved verifying presence of PBDEs by use of X-ray fluorescence (XRF) equipment.

2.3.3.1 Initial Assessment of PBDEs in EEE/WEEE and transport sectors

During the initial assessment of PBDEs in the EEE and WEEE in Uganda, the following were the major observations.

a. PBDEs and PBDE-containing articles have never been produced in Uganda.
b. CRT computers and TVs which might contain PBDEs are still in use in the country. It is, however, illegal to import second hand computers and TVs.
c. Uganda has an Electronic Waste Management Policy, 2012[2] which is yet to be fully implemented.
d. Data obtained from NITA Uganda, 2014, indicated that 2.5% of the Ugandan population own at least a computer.

The initial assessment revealed the following gaps in relation to management of PBDEs:

i. Lack of a national inventory of EEE and WEEE with a focus on PBDEs.
ii. The import register did not distinguish between new and second hand products for all articles.
iii. The available penetration data does not differentiate between CRT and non CRT monitors or TVs.

In the transport sector, the initial assessment of PBDEs in Uganda showed that:

a) Vehicles as old as 40-20 years are still in use in Uganda.
b) URA keeps a database of all imported cars while licensing is done by Ministry of Works and Transport (MoWT) and NIC.
c) Uganda Police has annual traffic and road safety reports.
d) UBOS captures all the national statistics.

2.3.3.2 Preliminary inventory c-OctaBDE in EEE/WEEE

Uganda has never done a comprehensive inventory of EEE/WEEE for the purpose of estimating the associated PBDE burden. Thus the preliminary inventory of PBDEs in CRTs in Uganda was based on penetration data of CRTs for Ghana. (*Guidance document table 4-1*). Based on this

[2] Ministry of Information and Communication Technology (ICT), 2012. Electronic Waste (e-Waste) Management Policy for Uganda.

data for Ghana, and given Uganda's population of about 34.9 million[3], the penetration rate of CRTs (number of CRTs per person) in Uganda was estimated to be 0.19[4].

The amount of CRTs in the country has been estimated using data in Table 6 and the range of commercial octabromodiphenyl ether (c-OctaBDE) in CRT devices was calculated as follows:

$M_{PBDE(i)}$ = [Number of CRTs/capita$_{Region}$] x population x 25 kg x 0.3 x [0.00087 to 0.00254]
Where:

$M_{PBDE(i)}$ is the amount of PBDEs in [kg] (in the polymer of electrical and electronic equipment (EEE)

From the calculations, the amount of c-OctaBDE in CRT monitors in Uganda was estimated to be between **45,374.8 – 132,473.7** kg. The estimated ranges of c-OctaBDE homologues in CRTs is given in Table 7.

Table 6: Showing additional data for calculation of POP-PBDEs burden in CRTs

Item	Value	Source
Population	34,900,000	UBOS, 2014
Weight of the CRTs	25 kg per device	Guidance document table 4-5
Polymer content of CRT casings	30%	Guidance document table 4-9
A range of c-OctaBDE content	0.87-2.54 kg/tonne	Guidance document table 4-11

Table 7: Composition of c-OctaBDEs

Homologs	**Distribution of homologues c-OctaBDE, %***	**Range of c-OctaBDE in kg**	
		From	**To**
HexaBDE	11	4991.2	14572.1
HeptaBDE	43	19511.2	56963.7
OctaBDE	35	15881.2	46365.8
NonaBDE	10	4537.5	13247.4
DecaBDE	1	453.7	1324.7
Total		**45,374.8**	**132,473.7**

**Adapted from table 2-2 of the Guidance document*

[3] UBOS, 2014. National Population and Housing Census 2014

[4] Green Advocacy, Empa. 2011. Ghana e-Waste Country Assessment. Report of component 1&2 of the UNEP SBC E-waste Africa Project for Ghana. Accra, Ghana: Ghana & Switzerland. http://www.ewasteguide.info/Amoyaw-Osei_2011_GreenAd-Empa

2.3.3.2.1 Estimation of amount of c-OctaBDEs in imported EEEs

The estimation of c-OctaBDEs in the imports of EEEs were done following the UNEP Guidance document. Generally, whereas the importation of computers has increased during the 2010-2014 period (*Figure 2*), the proportion of CRT monitors and CRT–TVs have decreased in the same period (*Figure 3*). Conversely, a general increase in imported photocopiers and flat screen TVs was observed (*Figure 3*).

Figure 2: showing a five year trend in importation of computers

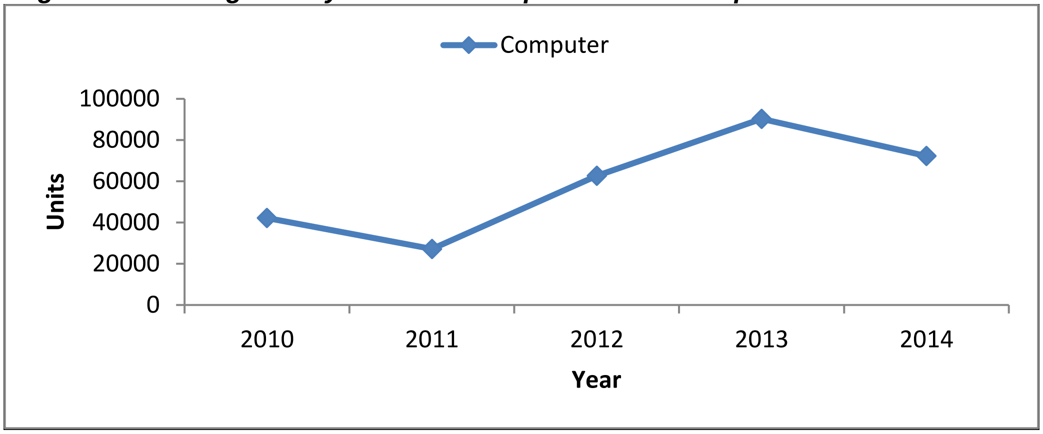

Figure 3: showing a five year trend in importation of CRT Monitors, TVs and Photocopiers

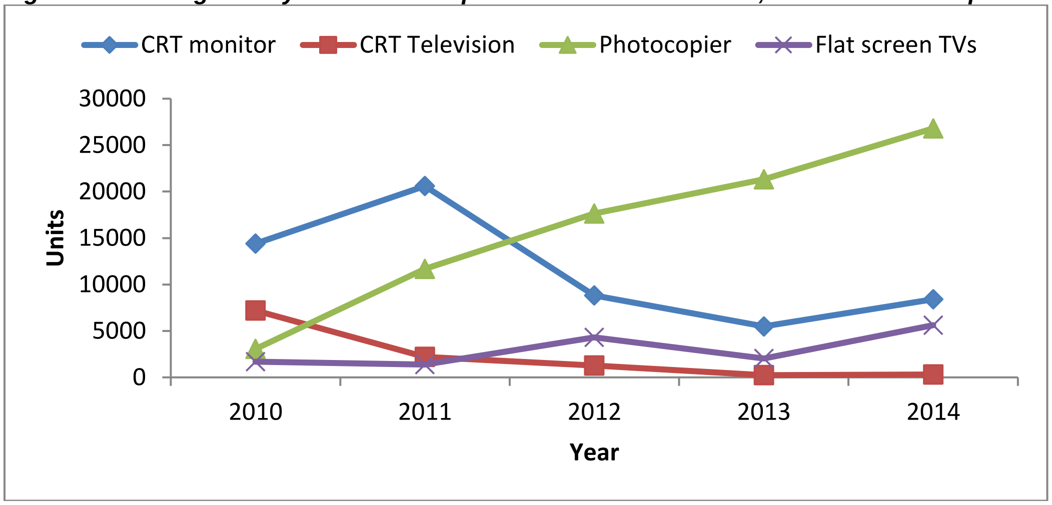

Table 8: Estimated POP-PBDEs in EEE from household stocks

Category	**Product**	**Amount of stocked EEE (tonnes) in 2014 (a)**	**Total polymer fraction in EEE (%wt) (b)**	**Content of c-OctaBDE in total polymer fraction of EEE (kg/tonne) (c)**	**Total amount of c-OctaBDE (kg) (a) x (b) x (c)**
3	CRT monitors	26791	30%	2.54	2041.4
4	CRT TVs	199071	30%	0.87	51957.5
Total					**53998.9**

Up to about 54000 kg of c-OctaBDEs were estimated to be contained in EEE stocked by households (*Table 8*)

2.3.3.2.2 Estimation of POP-PBDEs in CRTs in use

The number of CRT computer monitors in use (57,725 in *Table 9*) was estimated from the five-year importation data obtained from URA, on the assumption that the life span of these CRT monitors is 5 years[5]. From the Uganda Communications Commission (UCC) data, it was estimated that the total number of TVs in the country was 3 million[6]. From field surveys by the inventory team, it was discovered that CRT TVs take up 69% of total number of TVs in Uganda. It can therefore be concluded that 69% of the 3 million TVs in Uganda are CRTs, i.e. 2,070,000. Consequently the POP-PBDE burden in currently used CRTs was estimated to be about 17,700 Kg (Table 10), the CRT-TVs contributing over 95% of the burden.

Table 9: Estimated total weight of CRTs in use in Uganda

Category	Items	Sum	Estimated weight of item (Kg)	Total weight Kg	Total weight in Uganda (tonnes)
3	CRT monitor	57,725	14.1	813,922.50	**813.92**
4	CRT TV	2,070,000	31.6	65,412,000.00	**65,412.00**

Table 10*: Estimated POP-PBDE burden in currently used CRTs*

Category	Product	Amount of stocked EEE (tonnes) in Uganda (a)	Total polymer fraction in EEE (%wt) (b)	Content of c-OctaBDE in total polymer fraction of EEE (Kg/tonne) (c)	Total amount of c-OctaBDE (Kg) (a) x (b) x (c)
3	CRT monitors	813.92	30%	2.54	620.21
4	CRT TVs	65,412.00	30%	0.87	17,072.53
Total					**17,692.74**

2.3.3.2.3 EEE entering the waste stream

There is no functional EEE and WEEE management system in the country. Most of the EEEs including CRT computer monitors and CRT-TVs end up in the informal sector all over the country. The EEE may be repaired or used for recovery of spare parts for other applications. Interviews with the informal sector players revealed that due to lack of guidelines, disposal of the remaining parts is largely by burning or disposal with domestic waste. It was further observed that some workshops convert CRT-computer monitors to TVs, providing cheap alternatives to homes and businesses.

2.3.3.3 Inventory of c-Penta BDEs in the Transport Sector

The transport sector was identified as very relevant for the inventory for c-Penta BDEs in Uganda. Because POP-PBDEs were largely used in vehicles produced in the period between 1975 and 2004, only these were inventoried for the POP-PBDE burden.

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[5] UNIDO, project No. UE/UGA1/2/001, 2013. Inventory on e-waste management practices in Uganda. Submitted by Uganda Cleaner Production Center.

[6] Communication from an Environment Management Specialist from the Uganda Communications Commission. 2nd July, 2015.

2.3.3.3.1 Estimation of number of old vehicles using the Environment levy

The vehicles which were manufactured between 1975 and 2004 are in use around the country and they are still being imported. There are no age restrictions on the imported vehicles. In addition, there is no roadworthiness inspection for the vehicles before they are shipped to Uganda.

In 2006, the Government announced a 10% environmental levy and later increased it to 20% on motor vehicles (excluding goods vehicles) which are eight (8) years or older (at importation), in order to discourage what it termed 'environmentally hazardous used goods'. In 2007, it went a step further and introduced an environmental levy on vehicle parts, used motorcycles and bicycles, all critical components of the transport sector.

The import data for vehicles for the inventory year (2014) was obtained from URA. This data did not declare the vehicle year of manufacture. Therefore, the best practical way to estimate the number of vehicles manufactured between 1975 and 2004 was to use the environmental levy records. Using that criterion, it was found that out of the total vehicles imported, 70.3% are used and 29.7% are new. Some vehicle categories (Tractors, Goods vehicles, and the Special vehicles) are exempted from the levy and are, therefore, captured as new.

2.3.3.3.2 Estimation of POP-PBDEs in Polyurethane foam articles (vehicles manufactured between 1975 – 2004)

Polyurethane (PUR) foam fraction in vehicles (seats, head and arm rests) contained c-PentaBDE which was was applied in 0.5 to 1% by weight. For head liners, up to 15% of c-PentaBDEs has been used. The total amount of POP-PBDEs in PUR foam of imported vehicles in the inventory year was about 427 Kg (Table 11).

Table 11: Amount of POP-PBDE in PUR foam of imported vehicles in inventory year (2014)

Vehicle type Imported	**Nmber of Vehicles imported**	**Amount of c-PentaBDE per vehicle (kg)**	**Total c-PentaBDE (kg)**
Cars/Trucks (mnufactured in US before 2005)	30	0.16	No. of cars and trucks x 0.16 kg x 0.5*= **2.4**
Cars/Trucks (mnufactured in Asia, Europe and other regios before 2005)	29388+578+34+1 =30,001	0.16	No. of cars and trucks x 0.16 kg x 0.05*= **240**
Buses (manufactured in US before 2005)	1	1	No. of buses x 1 kg x 0.5*= 0.5 kg
Buses (manufactured in other regions before 2005)	3,673 + 10 + 1 + 1 = 3,687	1	No. of buses x 1 kg x 0.05*= **184.4**
Total c-PentaBDE			**427.3**

**Factor estimating the share of impacted vehicles in the region of production (only from 1975-2004)*

2.3.3.3.3 *Estimation of POP-PBDEs in Polyurethane foam articles (Vehicles currently in use)*

In addition to URA, data on vehicles that are in use was obtained from Ministry of Works and Transport, through the Transport Licensing Board (TLB), Uganda Investment Authority (UIA) and National Insurance Corporation (NIC).

Table 12: Amount of POP-PBDES in PUR foam of vehicles in current use in 2014

Vehicle type	Nmber of Vehicles	Amount of c-PentaBDE per vehicle (kg)	Total c-PentaBDE (kg)
Cars/Trucks (mnufactured in the Asian Pacific before 2005)	5-1b	0.16	**187,186 x 0.16 kg x 0.05*=1,497.488**
Buses (manufactured in the Asian Pacific before 2005)	5-1d	1	**120,721 x 1 kg x 0.05*= 6,036.05**
Total c-PentaBDE			**7,533.54**

As shown in Table 12, buses contribute about 80% of the total estimated amount of POP-PBDEs in currently used vehicles.

2.3.3.3.4 Estimation of POP-PBDEs in end-of-life of vehicles (ELVs) for the inventory year 2014

There is no functional sound system of deregistration and tracking of ELVs in the country. This presents significant limitations in estimating the quantity of ELVs countrywide. Therefore, the number of vehicles joining the waste stream was estimated by the number of total vehicles in use and their expected life expectancy using the following equation:

$$\text{ELVs generated per year} = \frac{\text{Vehicles stock piled}}{\text{life span}}$$ ([7]).

The average life span of vehicles entering Uganda is estimated at 15 years[8]. A projection of the current number of ELVs in the inventorying year 2014 (based on a 15 year average) is shown in the **Table 13.**

Table 13: Projection of number of ELVs in the inventory year 2014

	Vehicles in use (manufactured before 2005)*	Number of ELVs per year
Cars/trucks	187,186	12,479
Buses	120,721	8,048

**These are about 70% of overall number of vehicles in Uganda*

From the above table, the amount of POP-PBDEs in ELVs was calculated as shown in Table 14 below.

[7] *Section 5.3.7 Calculation of POP-PBDEs in ELVs for the inventory year – Guidance document, 2012*
[8] Senfuka Christopher, 2011, Sustainability and value of steel recycling in Uganda. Journal of civil Engineering and construction Technology, Vol. 2(10), pp 212-217

Table 14: POP-PBDES in ELVs

Vehicle type	Nmber of Vehicles	Amount of c-PentaBDE per vehicle (kg)	Total c-PentaBDE (kg)
Cars/Trucks (mnufactured in the Asian Pacific before 2005)	5-3b	0.16	12,479**x 0.16 kg x 0.05=99.832**
Buses (manufactured in the Asian Pacific before 2005)	5-3d	1	8,048**x 1 kg x 0.05= 402.4**
Total c-PentaBDE			**502.23**

Buses contribute about 80% of POP-PBDEs in ELVs.

2.3.3.3.5 *Fate of vehicles in Uganda*

In the garages, some of the vehicles eventually reach their end of life and they are stripped down for reusable parts and metal recycling. The non-metallic and unsold parts are usually found lying on the ground within the garage premises, others burnt in open air, while othern various applications. These provide various pathways of associated POP-PBDEs into the environment. The locations of these garages differ as some are in business areas while some are informal because they are in private homes.

2.3.3.3.6 PBDEs in other consumer products

Other consumer products such as furniture, mattresses and textiles have been assessed for POP-PBDEs burdens. These products were not found to be sufficiently burdened for relevance to to the POP-PBDEs inventory in Uganda.

2.3.3.4 Plastic Recycling

The commercial PentaBDE and OctaBDE are listed in Annex A for elimination under the Stockholm Convention but includes a specific exemption allowing for recycling of articles that contain these substances and the use and final disposal of articles manufactured from recycled materials that contain or may contain these substances.

The situation analysis showed that plastic recycling is growing fast in Uganda. Plastics such as polyethelyne (PE), and polypropylene (PP) are recycled from local sources, mainly producing polythene bags and sheets. The study has observed that jerrycans, basins, mineral water bottles, beverage bottles and many other plastic containers are among the most frequently scavenged from waste for recycling. These are picked from the waste skips, waste disposal trucks, and waste scavenging from the landfills. A closer look at the types of waste plastics revealed CRT casings and other electronic parts in the waste. Some bottles previously used for pesticides and other toxic chemicals were also recovered from general waste landfills and taken for recycling with other plastics.

2.3.3.5 In-depth inventory

The in-depth inventory involved reading concentrations of bromine in different articles using the X-ray Fluorescence (XRF) instrument (*ElvaX ProSpector,* Elvatech Ltd, Ukraine). For this particular analysis, it was assumed that the only source of bromine in the screened articles was the PBDEs. . The articles were screened for bromine and other elements such as Lead, Chromium, Mercury and Cadmium. These results were given in parts per million (ppm). Samples analysed included plastics, PUF from vehicles, CRT and LCD monitors as well as laptops, CRT televisions and general plastics. The results are summarised in Table 15 below.

Table 15: Summary of the XRF analysis (Bromine concentrations)

Category	Sub-Category	N	Mean (ppm)	Minimum value of the positives (ppm)	Maximum value of the positives (ppm)	Percentage detection (%)
Vehicles	Plastics	26	0.9	1	15	23
	PUF	22	837.2	3	4647	100
Computers	CRT	29	24367.0	59	135525	76
	LCD	21	410.7	96	7944	24
	Laptops	7	220.1	14	781	71
TVs	CRT	36	21156.7	7	69232	83
Plastics	General	55	144.8	1	6886	25
Dumpsite	General	39	4.54	1	124	18

Vehicles

The vehicles analysed were those in scrap yards and also from parking yards (in-use). The vehicles analysed were predominantly of Japanese origin. This is not surprising since over 90% of cars imported into Uganda are from Japan. The plastics of the vehicles analysed included the dashboards and door covers. Only 23% of the vehicle plastics analysed had detectable amounts of PBDEs (Table 15).

PUF

Car-seat PUFs were analysed. All vehicle seats analysed had detectable amounts of PBDEs. PUFs contained close to 1000 fold more PBDEs than the plastics in vehicles. It was however noted that 81.8% of the readings from the PUF did not fail the Restrictions of Hazardous Substances (RoHS) directive. The RoHS for PBDEs must not be more than 1000 ppm in a homogenous material[9]

Computers

The computers analysed were from organizations, universities and workshops. The majority of the computers were made in China between 1990 and 2014. CRT monitors contained the highest amount of PBDEs as compared to LCD monitors and laptops (Table 15). It was also noted that CRT monitors from Gateway, USA (13.3% of the total CRT monitors analysed) did not have any detectable amounts of PBDEs.

CRT Televisions

The sampling was done on TVs in households, institutions and repair workshops. A total of 22 brands were analysed. One of the challenges faced in this sampling was the fact that most TVs lacked years of manufacture although their brands were clear. Their mean concentration was 21156.67 ppm which was comparable to that of CRT monitors.

Plastics

[9] Arcadis and RPA, 2008, Study on RoHS and WEEE Directives No. 30-CE-00-296/00-09.

The sampling was done at hardware stores, recycling factories and in households. The plastics sampled ranged from plumbing, electrical fittings, roofing material, heavy duty polyethenes, industrial plastics and household materials (e.g. basins, jerricans, water tanks and baby toys). The plastics had a mean of 144.76 ppm with the highest value registered from a toy bus from china (6886 ppm).

Dumpsites

The sampling was done at Masese III site in Jinja Municipality and Katikolo site in Mukono Municipality as well as the Bwaise scrap yard in Kampala City where open burning of waste was practiced. From these three, it was observed that the waste was manually sorted at the site. These dumpsites had a mean PBDE concentration of 4.54 ppm with the highest value obtained being 124 ppm and this was at the Bwaise scrap yard.

Overall, there were detectable levels of heavy metals in vehicles, computers, TVs, plastics and dumpsites.

2.3.4 Assessment of PFOS, its salts and PFOSF (Annex B, Part III chemicals)

2.3.4.1 Methodology for PFOS Assessment

PFOS have unique physical properties of both fat and water repellence which makes them popular in manufacture of several products. They are typically used for surface treatments and common in non-stick products, stain resistant fabrics and weather clothing.

The inventory of PFOS was carried out using standard questionnaires provided in the guidance for inventory of PFOS and related chemicals issued by UNEP. The questionnaires were modified to suit the articles, products and sites covered in the scope of this inventory. The modified questionnaires were used to collect the data about possible PFOS-containing consumer products and the related stakeholders, including: carpets, chemical industries and products suppliers; retailers of commercial products; synthetic leather manufacturers, importers and retailers; textile manufacturers, importers and retailers; fire fighting foams and waste treatment facilities.

The data for national estimates for the articles and products or waste fractions were collected using the questionnaires that covered the following aspects: particulars of respondents; total yearly imports of articles and products suspected to contain PFOS; type or kind of articles or product dealt with; type of trade involved, downstream users, upstream suppliers; awareness of PFOS, its salts, and PFOS-F; waste generated and waste management; size of stockpiles; amounts of wastes dumped and contaminated sites; location of waste dump sites and stock piles.

2.3.4.2 Findings from the Assessments

2.3.4.2.1 Synthetic Carpets

The findings showed that the carpets that are traded are synthetic (100%), stain resistant (100%), dirt resistant/repellent (100%), oil and grease repellent (80%) and some contain flame retardants (20%). These are characteristic properties of PFOS containing articles and products, which indicates that these carpets could be containing PFOS or alternative substances with properties similar to PFOS.

Although the inventory attempted to quantify the carpets in the country, it should be noted that much of the carpet materials on the market may be PFOS free. This is because the information available indicates that since 2003, most producers of carpets have been phasing out use of PFOS in favour of alternative substances to PFOS. The main risk to the environment, relating to PFOS contained in carpets, is mainly in stockpiles, waste dump sites and landfills where PFOS containing carpets are dumped. Investigations and observations at the landfills and compost areas indicate that 85% of the total waste collected is organic matter and only 15% includes the rest of wastes with only 0.1% (of 15%) as synthetic carpets. The study also shows that there is ignorance by respondents on the existence of PFOS and related substances.

2.3.4.2.2 Synthetic Leather

Products and articles involved in this category were bags, shoes and belts. From the figures provided by the main importers, the total of sythetic leather products in Kampala alone was estimated at 835,000 kgs which represented 459,520 kgs (56%) of ladies' bags and 375,975 kgs (46%) as shoes. However these figures were found to be more than the quantities declared to the Customs Department of URA. One possible reason could be smuggling of imports into Uganda through the porous border points.

Interviews with the importers and other traders indicated that 91% of the respodents believed that the leather traded is synthetic and had properties ranging from water resistence (100%), stain resistant (73%), dirt resistant/repellent (81%) and least believe that the leather is oil and grease resistant (55%). These are properties exhibited by products containg PFOS–related substances, which could indicate presence of PFOS in these articles and products.

It was difficult for the study to quantify stockpiles because extracting such data from traders proved difficult. Significant levels of ignorance of respondents of existence of PFOS–related substances in articles and products traded were exhibited by most respondents. The respondents indicated that any wastes generated from traders and users is sent to the landfill and is collected by private operators or managers of city or municipal waste departments.

2.3.4.2.3 Synthetic Textiles

Importers and downstream traders of textiles who were contacted are involved in trading clothing and fabrics, sportswear, overalls and jackets. It was challenging for the inventory study to determine the quantity of textiles on the market due to the difficulty in obtaining data on stockpiles and yearly imports from different traders scattered in different districts of the country. Basing on data obtained from URA a total of **15, 689,546 kg** of synthetic textiles is imported in the country every year. According to respondents, most articles and products in this section are imported from China (64%) and others from UAE, Malaysia and Thailand.

Most of the traders interviewed (82%) indicated the synthetic textiles are stain resistant, 52% water resistant, and 45% are oil and grease resistant meaning that they could be containing PFOS–related substances. No investment was found in manufacturing of impregnated textiles, disposal of impregnated textiles and cleaning or repair of clothing, apparel, upholstery, sportswear, jackets and apparels, and furniture made with impregnated textiles. Likewise, the wastes for textiles are taken to landfills managed by the city and municipal authorities.

2.3.4.2.4 Insecticides

The only known PFOS containing insecticide is called N-Ethyl Perfluorooctane Sulfonamide (Et FOSA; CAS No. 4151-50-2). It is considered to be of commercial importance in agricultural plantations and other subsistence farming practices to kill farm pests, especially termites or as a bait for ants. Searches in the MAAIF database indicated that it is not officially imported in Uganda.

2.3.4.2.5 Fire Fighting Foams

The study has established that there are two (2) brands of FFFs used in Uganda: Aqueous Film Foaming Foam (AFFF) which comes in concentrations of 3% or 6%; and Film Forming Fluoro Protein (FFFP) which comes in the concentration of 3%. Most respondents (75%) use AFFF 3%. From the PFOS, its salts and PFOS – F inventory guidance document, it is confirmed that both AFFF and FFFP contain PFOS – related substances.

Table 16: Amount of FFF imported per year, stockpiled and used in a year

Agency/Company	FFFs imported per year (Liters)	Stockpiles (Liters)	Amount used
Directorate of Fire and Rescue Services – Uganda Police	10,000	11,800	620
Total (U) Ltd	16,000	12,000	-
Fire Masters	-	5,000	-
Fire Technologies	-	1,000	-
Fire & Safety Appliances	5,000	625	-
CAA Fire & Rescue Services	10,000	27,000	200
EJAF	8,000	20,000	-
River Aswa Police & Fire Brigade – Gulu	-	200	80
Uganda Police Fire Brigade – Mbarara	-	130	250
BIDCO (U) Ltd		350	50
Total	**49,000**	**80,105**	**1,200**

The assessment also established the companies from which these substances are imported into the country, namely: NAFFCO (45%) and Firex (18%), both Dubai based companies. The main Importers of FFF were: PFO Foam International and KB Technical services, located at Nakasero hill in Kampala.

Regarding wastes, 50% of respondents indicated that they use services of waste management companies (especially EPISILON) for disposal of FFFs waste. EPISILON dumped the FFF and other chemical wastes in Nakasogola army waste management facility.

Also noteworthy, some of the fire-fighting companies have fire-fighting training grounds and fire-fighting foams have been used in incidences involving fuel tanker accidents. These are potentially contaminated sites around the country.

2.3.4.2.6 Aviation Hydraulic Fluids (AHF)

Respondents from Eagle Air Hunger indicated that approximately 10 litres of aviation hydraulic fluids are used per year since an airplane consumes 0.01 litres per hour. The AHF used include among others: HUDE.FLUID; MIL-H- 5606; MOBIL JET OIL II and; AEROSHELL 100 PISTOENG. Estimate of the Quantity for other Hungers (4-7 small airline companies registered in Uganda) would not make it more than 50 liters of AHF in total used in a year for the entire country. The disposal of all used oils including aviation hydraulic fluid is done by Epsilon – which disposes most of the chemical and related wastes. There are no viable alternatives to PFOS applied AHF, which means that all the quantities used in the country contain PFOS. The danger to the environment from AHF is however limited given the small quantities of AHF in the country.

2.3.4.2.7 Waste Disposal and Waste Management

Four (4) major Municipal waste dumping sites were visited in Kampala City, Jinja, Gulu and Mbarara Municipalities. These are Kitezi landfill, Masese dumpsite, Laroo division dumpsite, and Kenkombe Municipal Solid Waste Composting (CDM/MSWC, respectively.

Much of wastes dumped at Masese dumpsite consists of organic matter (80 – 90%) and other wastes (10 -20%) like plastics, shoes, leather products, clothing’s and apparels, hygienic articles and cosmetics, synthetic carpets, industrial and household cleaning products, boxes, broken glasses, plastic bags (locally known as *Kavera*), synthetic textiles e.t.c. A total of 6 skips of 3–4 ton truck are delivered on a daily basis. Estimates indicate that for each 4-ton truck delivered at the site: 0.74% is synthetic leather (4.4kg i.e. bags, shoes, belts); 1.34% is textile (8.04 kg i.e. clothing's, apparels and jackets) and 0.1% of carpets (0.60 kg) . Estimates show that a total of 21,190 kg – 28,252 kg of synthetic articles and products suspected to contain PFOS–related substances is dumped at Masese dumpsite annually. There are cabins to store the sorted organic matter for selling to farmers. Leachate from the landfill appears likely to contaminate the farming activities in the neighbourhood.

Other dumpsites around the country have similar waste segregations as Masese dumpsite. Laroo dumpsite has a total of 13,383 – 18,294 kg of synthetic articles and products suspected to contain PFOS – related substances dumped on-site. Likewise for Kenkombe Garbage Composite Project in Mbarara Municipality, 47,711 kg – 63,540 kg of synthetic articles and products suspected to contain PFOS – related substances is dumped. The site at Laroo in Gulu Municipality is less populated with a swamp on the lower end of the landfill. There is also a borehole in a distance of about 300meters from the landfill and a stream from the swamp runs across the entire municipality. This indicates that there is potential environment and human health impact from PFOS-contaminated leachate.

As for waste in Kampala Capital City, the daily quantity of waste collected and dumped at Kitezi landfill is estimated to be 10,000 – 11,000 tons of wastes of which 85% is organic matter and others like shoes, leather, plastics, metal, TV & Computer scraps etc make 15%. Treated waste water is regulary monitored by carrying out analytical tests such as BOD and COD in the laboratory which is availalble at the treatment plant. The final treated wastewater is then allowed to flow to the nearby streams through a bed of reeds that further filter the water.

2.3.4.3 Confirmation of PFOS in Articles and Products

2.3.4.3.1 National Estimates of the articles and products suspected to contain PFOS

Table 17 summarizes articles and products according to quantities imported and traded annually, stockpiles and national estimates of contaminants in each category for these products and articles that contain PFOS, its salts and PFOS – F.

Table 17: National Estimates of articles and products suspected to contain PFOS

Article or Product	Amount imported Annually in Kg or L	Amount Traded Annually in Kg or L	Stockpiles Kg or L	National Estimated Content of Articles and Products at Contaminated Sites Kg or L
Carpets	-	303,200	-	29,150
Leather	690,760	835,000	-	217,020
Textiles	15,689,616	1,661,000	-	395,060
Fire fighting Foams	49,000	-	80,250	1,200
Aviation Hydraulic Fruids		50L		

2.3.4.3.2 Calculating PFOS Content in Articles and Products in the Country

PFOS was calculated according to the guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on POPs, July 2012 document and results are reported according to Annex 14 of the same document.

Table 18: PFOS content estimates annually for articles and products in the country

Category of Article or Product	Year of Phase Out	Amount Imported Kg/Year	Amount Manufactured Kg/Year	Amount Exported Kg/Year	PFOS Content (mg PFOS/Kg article or product	PFOS Quantity (tonnes/Year)
Carpets		303,200	-	-	500 –5000	Low:0.1516 High: 1.516
Leather		835,000	-	-	500-5000	Low:0.4175 High: 4.175
Textiles		15,689,616	-	-	500-5000	Low:7.845 High:78.45
Fire Fighting Foams		49,000	-	-	5000-15,000	Low : 0.415 High : 0.735
Aviation Hydraulic Fluids		50	-	-	500-1,000	Low: 2.5×10^{-5} High: 2.5×10^{-4}

Table 19: National estimates of waste fractions of carpets, textiles and leather waste Management Facilities (Landfills and Composite Sites) dumped per annum

Article	Jinja Estimated Content Annually in Kg	Gulu Estimated content annually in Kg	Mbarara Estimated Content Annually in Kg	Kampala estimated content annually in Kg	Average Estimated content Annually in Kg*	National Total estimated Content in Kg**
Synthetic carpets	972 – 1,296	587 – 778	2,196 – 2,916	600,250 – 720,050	166,130.5	**3,322,610**
Leather	7,193 – 9,590	4,324 – 6,234	16,200 – 21,564	1,200,500 – 1,442,500	338,513.1	**6,770,262.5**
Textiles	13,025 – 17,366	8,474 – 11,282	29,315 – 39,060	1,200,500 – 1,442,500	345,190.3	**6,903,805**

**National average estimated content annually in Kg* x number of municipalities (20)

Table 20: PFOS content estimates for contaminated sites in the country

Category of Article and Product	Year of Phase Out	National Total estimated Content in Kg**	PFOS Content (mg PFOS/Kg article or product	PFOS Quantity (tonnes/Year)
Carpets		29,150	500 – 5,000	Low: 0.146 High: 1.46
Leather		217,020	500 – 5,000	Low: 0.109 High: 1.09
Textiles		395,060	500 – 5,000	Low: 0.198 High: 1.98
Fire Fighting Foams		1,200	5,000 – 15,000	Low: 0.006 High: 0.18

2.3.4.3.3 Evaluation of Study Data of PFOS – Related Substances in the Country

The values calculated in tables 19 and 20 are rough approximations of the amount of PFOS expected annualy in dump sites and in articles and products imported into Uganda. The following observations have can be deduced from the obtained values:

a) There is a significant amount of PFOS from textiles and leather articles, both in imported and contaminated sites in different parts of the country;

b) The amount of PFOS from aviation hydraulic fluids imported into Uganda is insignificant;

c) The data generated is likely to be affected by unknown values of carpets imported into the country. No imports were provided by the Customs Department of URA;

d) There is no data obtained about manufacture and export quantities for PFOS-containing articles and products. Uganda does not manufacture chemical products of PFOS and it is difficult to quantify stockpiles and quantities exported out of Uganda;

e) The total estimated quantity of PFOS imported annually is in the range of 8.83 – 84.88 tonnes per year; and,

f) Though significant amounts of PFOS from fire fighting foams is imported into Uganda (0.415 – 0.735 tonnes /year), and measurable amounts of stockpiles in Uganda (0.401 – 1.204 tonnes), the amount of fire fighting foams disposed is low (0.006 – 0.18 tonnes/year) which indicates need to monitor stockpiles.

2.3.4.4 Constraints and limitations in the data obtained

There were constraints and limitations during the inventory that could have effect on the estimates of PFOS generated.

(i) Quantification of stockpiles from traders was difficult as traders were not able to cooperate or did not have data at hand regarding their stocks – especially the stockpiles generated over the years.

(ii) KACITA was not able to provide the total number of importers, traders for each article of interest in the study. As such, there is a big difference between data from Customs Department of URA and figures provided by KACITA in case of textiles and leather traded in Kampala.

(iii) The Customs Department of URA could not provide data on some of the articles such as carpets. Hence, it was difficult to validate data and information obtained from importers.

(iv) The estimates based on data collected for articles or products in the contaminated sites such as Masese landfill, Laroo Landfill etc. is a rough representation of the many contaminated sites in Uganda. The study was not able to obtain representative data from locations in the villages and rural areas where there are no dumpsites and landfils due to limited resources.

(v) The biased and generalised data from traders could affect the estimates since some respondents were estimating data, using such responses as “about” , “between”, “ I don’t know” and others.

(vi) The URA data is general and not captured according to the known product CAS numbers or product numbers. Most of the estimates are based on background information about the properties and origin of the articles and products. This brings in a margin of error resulting from possibity of including non-PFOS products in the estimation.

(vii) Stakeholders are not sensitised about POPs and their dangers and therefore there was lack of cooperation among some of them. Also some of the stakeholders gave scanty information that was required by the questionnaire which could have affected the estimates of PFOS in the country.

2.3.5 Assessment of releases of unintentional produced chemicals (Annex C chemicals)

2.3.5.1 Introduction

Annex C of the Stockholm Convention lists polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF), hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs) and, more recently, pentachlorobenzene (PeCB), as POPs produced unintentionally and released during thermal processes involving organic matter and chlorine, as a result of incomplete combustion or chemical reactions. These substances and their congeners make up the group of dioxins and furans.

There are generally four sources of unintentional release of POPs, three of which are active, ongoing processes, and one is a legacy of historic activities:

(i) Chemical production processes: in facilities or units that produce chlorinated phenols or in which certain other chlorinated chemicals are manufactured, or that produce pulp and paper using elemental chlorine for chemical bleaching;

(ii) Thermal and combustion processes: in waste incineration, combustion of solid and liquid fuels, or production of metals in thermal processes;

(iii) Biogenic processes: biological processes in which PCDD/PCDF may be formed from precursors – manufactured chemicals such as pentachlorophenol that are structurally closely related precursors of PCDD/PCDF.

(iv) Reservoir sources: these are sites such as historic dumps containing PCDD/PCDF and other POPs-contaminated wastes, and soils and sediments in which POPs have accumulated over time.

2.3.5.2 Status of dioxins in Uganda

The inventory identified nine sources of UPOPs that pose the greatest risk of emissions of dioxins and furans as outlined below:

(i) **Waste Incineration** mostly from medical waste and hazardous waste incineration.

(ii) **Ferrous and Non Ferrous Metal Production –**iron and steel foundries production.

(iii) **Heat and Power Generation** which addresses five source categories of large and small installations using fossil fuels, biomass or gas.

(iv) **Production of Mineral Products** which involves several processes ranging from mining to refining of mineral products.

(v) **Transport** which addresses source categories including road and ship transport.

(vi) **Open Burning Processes** which addresses two source categories of burning biomass or waste without technical equipment.

(vii) **Production and Use of Chemicals and Consumer Goods** which addresses eight source categories of various industrial activities.

(viii) **Miscellaneous** which addresses an array of source categories that do not match the description of any other source group.

(ix) **Disposal and Landfill** which addresses source categories related to waste disposal.

The spreadsheet (UNEP- POPs- PCDD/PCDF) was used to determine annual releases according to source groups and the year of reporting. Re-calculation was first done for the data of 2007 and then data collected in 2014 as shown in the table 21 below.

Table 21: Comparisons of annual UPOPs release from identified sources in 2007 and 2014

	Source Groups	**Annual Releases (g TEQ/a)**									
		2007					**2014**				
Group		**Air**	**Water**	**Land**	**Product**	**Residue**	**Air**	**Water**	**Land**	**Product**	**Residue**
1	Waste Incineration	7.1	0.0	0.0	0.0	0.8	1150.1	0.0	0.0	0.0	6.7
2	Ferrous and Non-Ferrous Metal Production	50.7	0.0	0.0	0.0	101.1	778.9	0.0	0.0	0.0	1191.3
3	Heat and Power Generation	486.5	0.0	0.0	0.0	0.7	167.3	0.0	0.0	0.0	68.6
4	Production of Mineral Products	9.4	0.0	0.0	0.0	0.0	22.8	0.0	0.0	0.0	0.0
5	Transportation	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
6	Open Burning Processes	252.1	0.0	10.5	0.0	0.0	190.3	0.0	9.2	0.0	0.0
7	Production of Chemicals and Consumer Goods	0	0.0	0.0	26.3	0.0	0.0	0.0	0.0	47.9	0.0
8	Miscellaneous	186.3	0.0	0.0	0.0	186.3	0.0	0.0	0.0	0.0	0.0
9	Disposal	0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	9.8	179.7
10	Identification of Potential Hot-Spots				0.0	0.0				0.0	0.0
1-10	**Total**	**992.2**	**0.0**	**10.5**	**26.3**	**288.9**	**2309.6**	**0.2**	**9.2**	**57.7**	**1446.3**
	Grand Total	**1317.9**					**3823.0**				

The total annual release into environmental vectors for 2014 was 3823g TEQ/a, with air receiving the highest percentage of the releases. This is nearly three times the total emission (1318 g TEQ/a) of 2007 inventory

Table 22: Summary of annual UPOPs release from identified sources in Uganda (2014)

	Source category	**Amount (g TEQ/a)**	**Predominant release source class**	**Amount (g TEQ/a)**
1	Waste Incineration	1150.1	Medical waste	1146.2
2	Ferrous and non-ferrous metal production	778.9	Iron and steel production	727
3	Open burning processes	90.3	Waste burning and accidental fires	177.4
4	Heat and power Generation	167.3	Household heating and cooking biomass	98.68
5	Production of Minerals Products	22.8	Cement Kilns	13.25
6	Transport	0.2	2-Stroke Engines	0.12
7	Production and Use of Chemicals and Consumer Goods -released to products, No releases to air	47	Leather plants	26.3
8	Miscellaneous	Insignificant	tobacco smoking and Crematoria	Insignificant
9	Disposal: in water, products and residues.	Insignificant release to air	Sewage/sewage treatment (in residue)	58.8
10	Contaminated Sites and Hotspots		Old sites for solid waste dumping; incineration sites; etc.	Not evaluated

The data indicate waste incineration; especially medical incineration has the greatest release source category followed by the Ferrous and Non-Ferrous Metal Production and the open burning of wastes. Air was the predominant recipient environmental medium of the unintentional POPs emissions, at 2309.6 g TEQ/a followed by residue at 1446.3 g TEQ/a. Compared to 2007 emissions inventory, there is increase in releases to all environmental vectors except for land due to decreased open burning, since waste collection efforts have increased in all urban areas of Uganda. According to results so far recorded in Uganda water receives no direct release of the unintentional POPs.

2.3.6 Information on stockpiles and contaminated sites in the country

Article 6, paragraph 1, item "e", of the Stockholm Convention text states that, 'each Party shall endeavour to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annex A, B or C; if remediation of those sites is undertaken it shall be performed in an environmentally sound manner.

2.3.6.1 Contamination from POPs Pesticides

According to the POPs pesticide inventory, there were no stockpiles of POPs pesticides in the country. However, sites that are possibly contaminated by POP pesticides were identified and mapped for future assessment. These included Ihungu in Masindi, Bukalasa Agricultural College in Luwero District; Bwanga Stock farm in Rukungiri District; Kinyara Ranch and Maruzi Ranch in Apac as detailed in Table 23.

Table 23: Suspected POPs Pesticide-contaminated Sites

Site	District	Suspected POP Pesticide	Sample taken	GPS Coordinates	Area Description
Ihungu Tsetse Stores	*Masindi*	Dieldrin	Dead bees from store floor	36 N 357077 184112	The site is adjacent to Kabarwana stream and swamp and located at the sub county offices. There is a contaminated building
Bukalasa Agriculture College dip	Luwero	Toxaphene	Soil samples from cattle dip site. Sample from tanning lime	36 N 445935 78312	The site has a contaminated building/ Dip site and is surrounded by an agriculture institution
Bwanga Stock Farm	Rukungiri	Toxaphene	Soil samples from dip site	36 M 169802 9897553	There is a contaminated building/ dip site The area is surrounded by vegetation characterized by high, low trees, grass & shrubs on hilly areas and Kahengye river adjacent to the farm
Kinyara Ranch	Masindi	Toxaphene	Soil samples from dip site	36 N 377913 175548	The site is a ranch with a Contaminated Building/ Dip site and adjacent to it is a swampy area located along Kampala - Masindi road
Maruzi Ranch	Apac	Toxaphene	Soil samples from dip site	36 N 415247 187440	The site has a Contaminated Building/ Dip site and is characterized by high and low vegetation types and adjacent to Lake Kyoga wetland system

2.3.6.2 Contamination from Polychlorinated biphenyls (PCB)

Suspected contaminated sites included:

(i) TANELEC a transformer servicing centre in Industrial Area, Kampala. This was because of clear presence of transformer oil spillages at the company yard as well as old faulty transformers awaiting collection.

(ii) Tibet Hima Mining company Limited (36 N 166930 22735) which has a large stock old transformers which were formerly owned by Kilembe Mines Company Limited;

(iii) MacLeaod Russel Uganda Limited in Kyenjojo in Mwenge Central, Birunda, Kyarusozi (36 N 226742 85360) which had stored capacitors which contain PCBs.

(iv) Epsilon Uganda Limited (36 N 455707 33439) is located in Kampala and is surrounded by business units and urban settlements.

(v) Lugogo Power Station (36 N 456234 35792) is surrounded by industrial, shopping centers and business units.

2.3.6.3 Contamination from Perfluoroctane Sulfonic acid (PFOS)

All sites where PFOS containing products and articles have been dumped are considered contaminated sites. In addition all sites where PFOS containing materials have been used are contaminated sites. In Uganda, the following sites could be regarded as PFOS contaminated sites, necessitating further assessment:

1) Landfills and dumpsites are used to manage city and municipality waste, since they receive considerable amount of PFOS substances from household waste. Also the areas that receive waste leachate and sludge from landfills and dumpsites are considered as contaminated sites.
2) PFOS-containing fire-fighting foam is used in airports, mines, oil and gas drilling, industrial sites, military installations, large power plants, fire sensitive installations. Deposits of PFOS-containing materials in landfills, dumpsites, agricultural land; or areas where large amounts of fire-fighting foams have been applied could be considered contaminated sites.

The inventory identified sites suspected to be contaminated with PFOS waste articles.

Table 24: PFOS Suspected contaminated sites in the country

Name	GPS Position	Location	Description
Kenkobe Garbage Compositing Project	36N 243938 9935555	Rwetondo, Kakoba Division in Mbarara	Byasiina stream, swamp, some informal settlements and subsistence farmlands close to the site
Kitezi Landfill	36 N 452776 45345	Kampala	The landfill is under the management of Directorate of Public Health of KCCA with Informal settlements, swamp vegetation and crop fields close to the site
Masese Land fill	36 N 525192 50148	Jinja	The landfill is under the management of Jinja Municipal Council. The site is on a relatively raised area characterized by vegetation and few informal settlements in the surroundings
Laroo Division landfill	36 N 425060 304139	Laroo Division in Gulu	Swamp and Pece river adjacent to the site
Koranorya	36 N 245582 9940124	Mbarara	Seasonal swampy area and close to a cattle ranch with few informal settlements
Rugando	36 N 224322 9929731	Mbarara	Seasonal swampy area and a small Kikyerenyo River close to the site along Kabale - Mbarara Road and a small market close to the site
Fuel Tank Namungona	36 N 449399 38193	Wakiso	The site is along the bypass road and located in a swampy area
British American Tobacco Company	36 N 458740 37475	Kampala	The site is in a built up factory area along Jinja - Kampala road
Crestform Mattresses	36 N 457268 37808	Kampala	The site is close to a stream channel and the surroundings consist of factories and warehouses
BIDCO	36 N 527386 49566	Jinja	The site is adjacent to Lake victoria shores
Mukono Landfill	36 N 469623 33503	Mukono	The site is close to Zirimiti wetland system with subsistence farmlands in the surroundings
Kamengo	36 N 420054 20017	Mpigi	Low lying swampy area along Masaka-Kampala road
Seeta	36 N 469899 41034	Seeta	The site is in a low lying area and within Lwajali wetland system
Namanve Industrial Area	36 N 464851 39242	Namanve	The site is located in an industrial area with swamp vegetation in the surroundings
Entebbe Airport	36 N 438281 4465	Entebbe	The site is on the Airport and surrounded by Lake Victoria catchment

Table 25: PFOS content estimates for contaminated sites in the country

Category of Article and Product	Year of Phase Out	National Total estimated Content in Kg**	PFOS Content (mg PFOS/Kg article or product	PFOS Quantity (tonnes/Year)
Carpets		29,150	500 – 5,000	Low: 0.146 High: 1.46
Leather		217,020	500 – 5,000	Low: 0.109 High: 1.09
Textiles		395,060	500 – 5,000	Low: 0.198 High: 1.98
Fire-Fighting Foams		1,200	5,000 – 15,000	Low: 0.006 High: 0.18

The estimates based on data collected for articles or products in the contaminated sites such as Masese landfill, Laroo Landfill etc. is a rough representation of the many contaminated sites in Uganda.

2.3.6.4 Contamination from Polybrominated diphenyl ethers (PBDES)

In general the vehicle scrap yards and the waste dumpsites may be deemed contaminated sites as the PBDEs may leach out of the exposed car parts into the environment.

In the transport sector, contamination of PBDEs can result from handling or disposal of waste polymers materials at the end-of-life treatment of vehicles. These materials include plastic parts, and polyurethane foams. Other contamination sources include disposal at landfills and littering in homes, scrap yards, garages , scenes of accidents and police stations.
For the electrical and electronics sector, there EEEs are kept in households or repair shops for extended periods. Some parts of the EEEs are recycled and the non-recycled parts are usually taken to dumpsites.

Dumpsites were visited and assessed for POP-PBDEs. These included the waste compositing plants at Masese in Jinja Municipality, Mukono Municipal, Kiteezi landfill in Kampala City and Bwaise scrap yard in Kampala City respectively. Other potentially contaminated areas include Kisenyi (Position: 36 N 452063 34285) and Naguru vehicle Inspection Centre (36 N 457408 36908).

It has also been observed that most solid municipal waste is not segregated and open burning is still practiced countrywide. This is a potential source of PBDE emissions into the environment and the combustion sites are potentially contaminated by PBDEs.

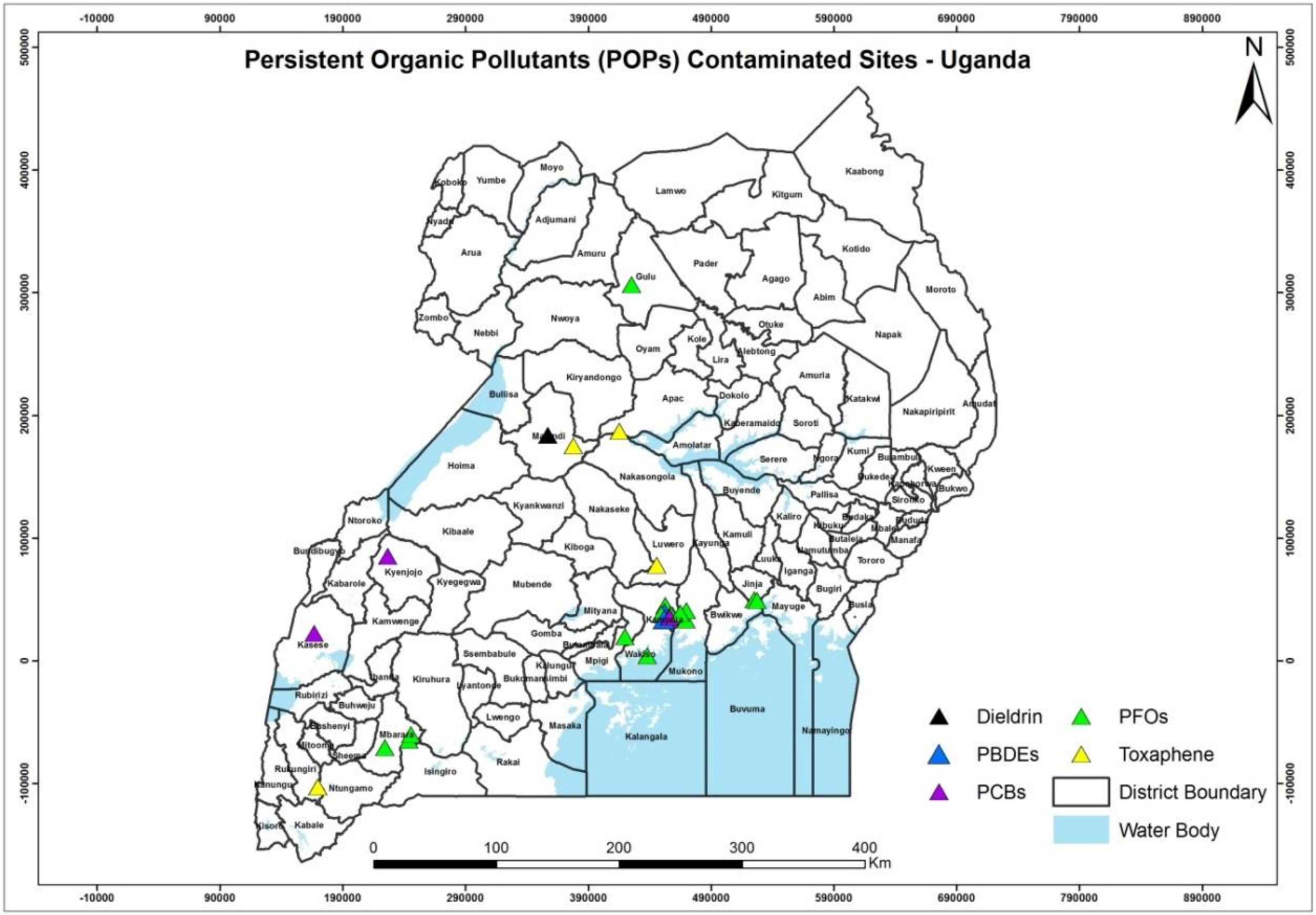


Figure 4: Location of POPs contaminated sites and proximity to water sources

2.3.7 Socio-economic Assessment

Socio-economic Assessment (SEA) provided a systematic appraisal of the potential social impacts of economic or other activities such as the management of Persistent Organic Pollutants (POPs) on all sectors of the society (including Government, local communities and groups, the civil society, and the private sector). The SEA 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. In the context of managing POPs, social and economic impacts includes; (i) vulnerability arising from exposure to POPs; (ii) deterioration or improvement in health; (iii) loss of improvement in livelihoods (iv) changes in cost of living (v) changes in employment, income and work place protection; (vi) levels of child labour; (vii) changes in levels of equity of wealth distribution; (viii) opportunities for enterprise development (including small and medium enterprises); and, (ix) changes in demand for public services, such as health, education and infrastructure.

2.3.7.1 Diagnosis of socio-economic for POPs management

The management of pesticides in Uganda is generally based on implementing existing regulatory arrangements and the pesticide management and control practices. The success of any future management strategy will likely focus on developing a database and following up on the lifecycle for existing stocks, stockpiles. In addition to implementation of regulations, technical capacity building for extension staff and use of alternatives to the new POPs will be important considerations as well.

The socio-economic assessment for PFOS showed that the major challenge is associated with PFOS estimation of articles on market, including those that are exported. Currently, URA Data on POPs is generalised and does not capture data based on known product CAS[10] Nos. In addition, stakeholders have low awareness on POPs and the associated impacts. Estimation of waste fractions is a challenge too because there are no dumping sites or landfills in some of areas where waste is generated especially in the rural areas.

The management challenge for POP-PBDEs is the identification of existing stockpiles and articles containing them and their disposal at end-of-life. Stockpiles and articles have accumulated due to the acute lack of high temperature incineration facilities. Consequently, dumping at non designated waste sites and low temperature open burning of waste are the common disposal methods. In both cases, there are releases of POPs into the environment through leachate and combustion. There is also considerable open air combustion of plastic waste of vehicles. The burning can be easily observed in garages and other stores.

Recycling and re-use of PBDE-containing vehicle parts occurs. There is no guarantee that the new applications offer more stability for the transferred article. In some cases the risk of emission could actually be increased.

There are stockpiles of electrical and electronics {mostly Cathode Ray Tube (CRT) including computers & TVs and transport – vehicles (cars, buses & trucks), among other PBDE containing articles in households, institutions, and public and private scrap yards that are not monitored. Lack of adequate related public awareness and continuous development changes influence the likelihood of poor disposal of these products, a concern that needs to be addressed.

[10] A **CAS Registry Number** is a unique numerical identifier assigned by Chemical Abstracts Service (CAS) to every chemical substance

2.3.7.2 Costs for management of new POPs

The cost of the different POPs management options is shown in Figures 7 and 8. The Figures show the discounted costs of POPs management over a five year timeline. The total discounted cost for implementing all options was USD10.13 million for the five year duration, while USD8.6 million or 85% of the cost was for enhancing incineration capacity. Incineration capacity enhancement has been proposed at this stage to provide a solution to management of stockpiles, recognising that with exemptions POPs articles will still be imported into the country and regulators will need to build incineration capacity as a long-term cost-effective option.

Figure 5: Cost of POPs management options, leaving out the incineration capacity.

(*NEMA, Socio-economic Assessment Report, 2014*)

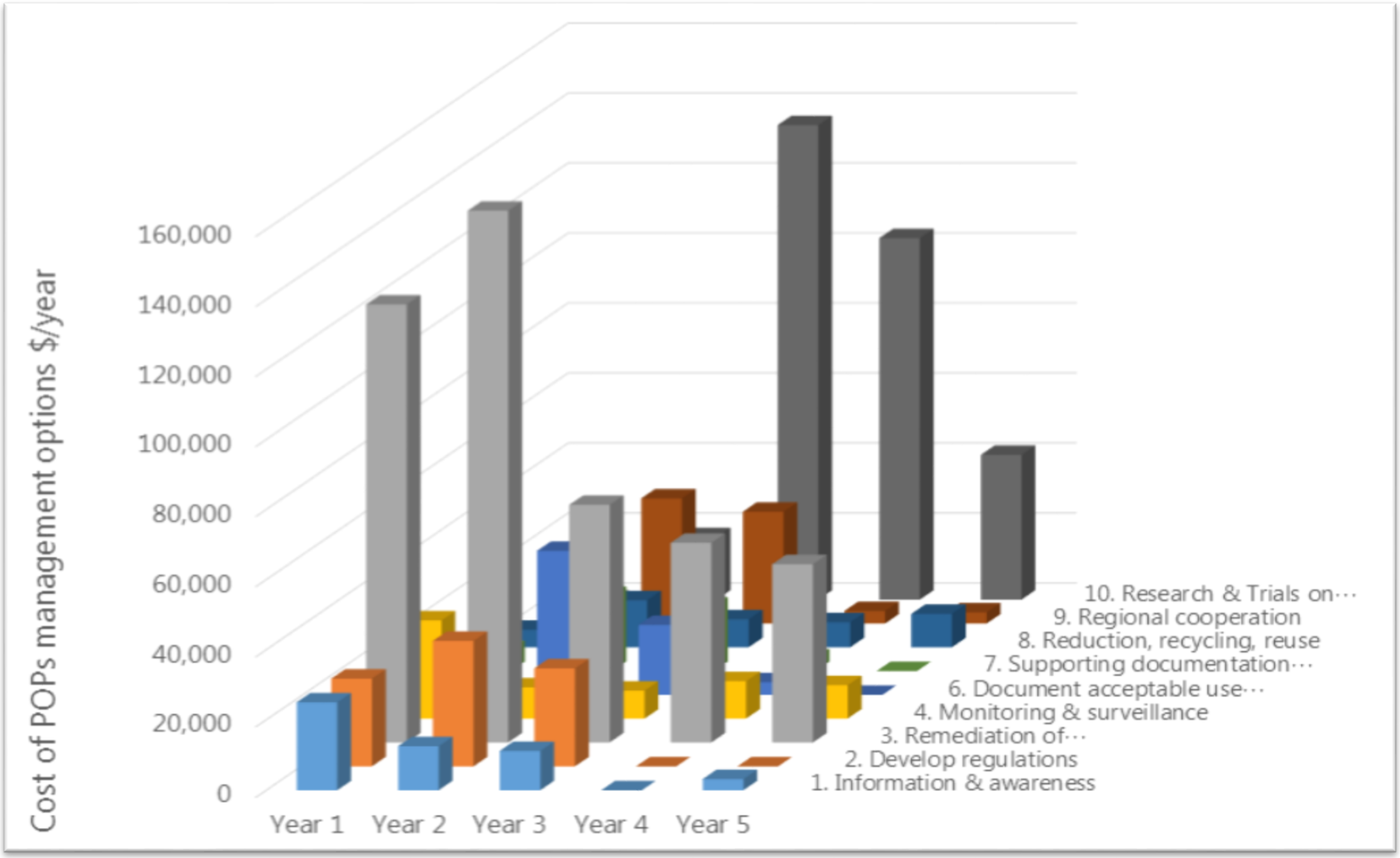
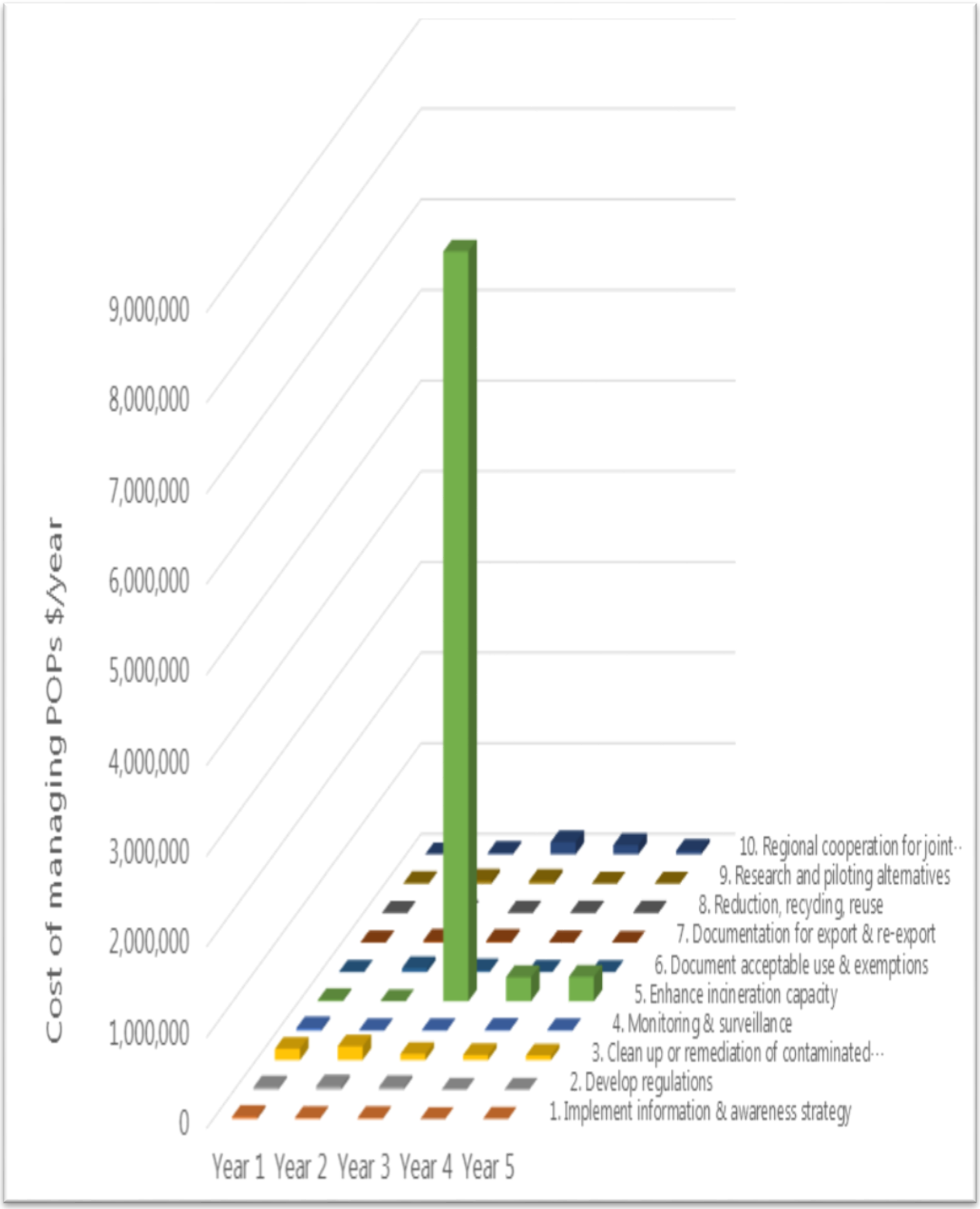


Figure 6: Costs of POPs management, standout cost of incineration capacity enhancement

(*NEMA, Socio-economic Assessment Report, 2014*)



2.3.7.3 Physical cost of not managing the new POPs

The benefit of implementing POPs management is assessed by computing the cost of not implementing the proposed management actions. The Stockholm Convention was purposely conceived to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health and/or on the environment. Exposure to POPs can lead to adverse health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and damages to the central and peripheral nervous systems. Moreover, given their long range transport, no one government acting alone can protect its citizens or its environment from POPs (Stockholm Convention Secretariat 2012). Therefore, inaction is expected to exacerbate the likely impacts and the cost of this will increase the burden for personal and public healthcare, result into socio-economic and environmental costs. The physical impacts are described based on 10 criteria, namely, vulnerability arising from exposure to POPs, impact on ecosystems & ecosystem services, deterioration or improvement in health, loss or improvement in livelihoods, changes in cost of living, changes in employment, income & workplace protection, levels of child labour, changes in levels of equity of wealth distribution, opportunities for enterprise development and changes in demand for public services such as health, education and infrastructure.

Other physical impacts that are not monetised

Other physical or socio-physical factors that may not be monetised but influence the decision to take action or not. These include the following:

(i) Multilateral regional relations between Uganda and the neighbouring countries influence agreements on management plans; and,

(ii) The state of Uganda’s economy bears on the decision making process at national level.

2.3.7.4 Monetary cost of inaction in managing POPs

In a research undertaken by UNEP (2013) which was based on submissions from different environment management agencies in Uganda, it was estimated that each farmer loses 24.6 days per year due to pesticide poisoning, including 9.4 days annually due to respiratory diseases, and 15.2 days annually for skin infections. In further assessment it was estimated that persons including farmers who experience serious incidents lose a maximum of 21 work days per year, with seven days spent in hospital; those who experience moderate incidents lose two-thirds of the maximum (14 days) per year, and those who experience minor incidents lose one third of the maximum (7 days) per year. These costs are distributed as follows: 1.2 % of users experienced serious incidents that required hospital treatment, 11.6% experienced moderate incidents requiring trained medical treatment, and 62% experienced a minor incident for which no trained medical attention was sought. The average daily per capital income was estimated as USD 5.8/day. These general results were used for calculations of the cost of inaction below. Other assumptions used were that the impact has a multiplier effect of 5, the average household size in Uganda (UBOS 2014), since most households have only one bread earner. Additionally, even for the case where children were exposed, the same factor was applied because of the diverted attention towards caring or treating a child. The only difference in the case of the children, the impacts were always maximum because of likely impacts later as the children grew up, while the impacts for adults could range from high, moderate to low.

Table 26 summarises the cost of inaction in the management of POPs. The highest burden is from economic income that affects on-going livelihoods from fisheries and crops. However, the health burden is also reasonably high. The accumulation of PBDEs and PFOS for example can in the long-term cause much more severe economic, social and environmental impacts that those indicated in the table. The cost of inaction is envisaged to increase from USD17.5 million to USD27.1 million from the first year of project (2014) to the fifth year.

Table 26 Summary of monetary cost of inaction in managing new POPs

Cost type	Discounted annual cost of not managing POPs $/year				
	1 (2014)	2	3	4	5
Health burden of PFOS	310,075	310,075	310,075	310,075	310,075
Health burden of PBDEs	4,932,396	4,932,396	4,932,396	4,932,396	4,932,396
Health burden of pesticides	2,777,927	2,777,927	2,777,927	2,777,927	2,777,927
Economic and social burden of PFOS and pesticides from losing fish livelihoods	6745000	5,845,667	5,845,667	5,845,667	5,845,667
Economic/environmental burden of PFOS and pesticides water resource costs	113,179	169,768	172,032	282,945	339,536
Economic and social burden of PFOS and pesticides from losing crop export income	2,579,740	5,159,480	7,739,220	10,318,960	12,898,700
Total	**17,458,317**	**19,195,313**	**21,777,317**	**24,467,970**	**27,104,301**

2.3.7.5 Cost-benefit analysis (NPV)

The present values of the cost and benefit stream were calculated at a 12% discount rate (Kaggwa et al. 2004). The present value of benefits averaged at USD17million/year while the present value of costs averaged at USD 2million/year even with the incineration capacity enhancement, over a five year timeline. The cost-benefit produced an average net present value of USD8.4 million/year over the five year timeline (Table 27). The only time the cost-benefit stream would be threatened is the year in which the incinerator investment takes place. Nonetheless, the present value of benefits would still edge the investment into viability.

Table 27: Computation of NPV ($/year) for management of new POPs

Cost type	Annual cost $/year					
	1 (2014)	2	3	4	5	Average
Cost of inaction or the Benefit if management action is undertaken						
Health burden of PFOS	310,023	310,023	310,023	310,023	310,023	310,023
Health burden of PBDEs	4,932,396	4,932,396	4,932,396	4,932,396	4,932,396	4,932,396
Health burden of pesticides	2,777,927	2,777,927	2,777,927	2,777,927	2,777,927	2,777,927
Fisheries	6745000	5,845,667	5,845,667	5,845,667	5,845,667	6,025,533
Water resource costs	113,179	169,768	172,032	282,945	339,536	215,492
Crop export losses	2,579,740	5,159,480	7,739,220	10,318,960	12,898,700	7,739,220
Total	*17,458,265*	*19,195,261*	*21,777,265*	*24,467,918*	*27,104,249*	*22,000,591*
Present value of Benefits $/year	*17,458,265*	*17,138,626*	*17,360,702*	*17,415,781*	*17,225,240*	*17,319,723*
Efficacy 60%	*10,474,959.0*	*10,283,175.4*	*10,416,421.2*	*10,449,468.3*	*10,335,144.0*	*10,391,834*
Cost of implementing management options: cost of managing new POPs						
1. Information & awareness	18,500	3,125	2,790	2,491	3,813	6,144
2. Develop regulations	22,500	7,589	9,566	712	636	8,201
3. Clean up & remediation of contaminated sites	75,000	58,036	71,747	32,030	15,888	50,540

Cost type	Annual cost $/year					
	1 (2014)	**2**	**3**	**4**	**5**	**Average**
4. Monitoring & surveillance	18,000	3,571	3,189	2,847	3,178	6,157
5. Enhance incineration capacity	15,000	4,464	8,470,185	266,918	270,095	1,805,332
6. Document acceptable use & exemptions (PFOS)	2,000	16,518	9,965	712	0	5,839
7. Develop supporting documentation for export & re-export to Parties & non-Parties	2,000	16,518	9,965	712	0	5,839
8. Reduction, recycling, re-using (PFOS & PBDEs)	2,000	10,714	5,580	3,203	6,037	5,507
9. Research & piloting alternatives	8,000	35,714	31,888	3,559	3,178	82,339
10. Regional cooperation for joint implementation	2,500	15,625	15,944	1,779	1,589	7,487
Present value of costs $/year	*165,500*	*171,874*	*8,630,819*	*314,963*	*304,414*	*1,983,385*
Net Present Value	10,309,459	10,111,301	1,785,602	10,134,505	10,030,730	8,408,448

2.3.8 Research, Development and Monitoring Programmes

Article 11 of the Stockholm Convention on POPs requires parties within their capacities to promote and conduct research on POPs, their prevalence in humans and the environment, their fate and effects on human health and environment as well as their socio-economic and cultural impacts. Furthermore, article 16 of the Convention requires parties to periodically evaluate effectives of the Convention through establishment of monitoring programmes to generate data on the presence of listed chemicals especially in the core matrices As noted in the guidance document for the Global Monitoring Programme (GMP), at least a monitoring period of 4-5 years is needed to get reliable estimates of the components of variance such as within- and between-years variations. No such monitoring programme has existed in Uganda and Africa at large.

Existing data on environmental monitoring of POPs in Uganda has so far been from sporadic studies, covering short study periods and in some cases, none core matrices. For instance, POPs (including dioxins and furans) have been reported in sediment and fish samples from Lake Victoria (*Kasozi et al.*, 2006; *Ssebugere et al*, 2014). Organochlorine pesticide residues have also been reported in soil and vegetable samples. In more detailed studies, (*Arinaitwe K, 2015 , Kasozi et al.*,2006; *Ssebugere et al*, 2014*)* have recently reported POPs (including PCBs and PBDEs) in air samples collected at various intervals within the 1999-2004 and 2008-2010 periods. The same study also profiled historical sedimentation of the POPs in Lake Victoria and two mountain Lakes, Bujuku and Mahoma, from the Rwenzori Mountains in Western Uganda. Other short studies monitored POP residues in human milk and blood. A more regular and sufficiently long monitoring programme, studying the core matrices of air, human blood, breast milk and water (for hydrophilic POPs and other hazardous chemicals, such as heavy metals) is required to enable more robust analyses of the time series. Since some of the transformation products of these chemicals are more persistent and toxic, the monitoring program will include such residues to facilitate better the policy formulation. This would be better enabled by upgrading the capacity of some of the already existing laboratories for POPs analysis in Uganda.

Another dimension of monitoring is the enforcement of standards in the manufacturing industry, agricultural production, waste management, importation of chemicals and consumer articles, in relation to the sector regulations. There is a huge need for trained human resource and facilitation for consistent law enforcement. This implies enhancement of laboratory and in-field capacity.

2.3.9 Public Information, Awareness, and Education

Article 10 requires that parties to the Convention within their capabilities create awareness among its policy and decision makers, institute mechanism for providing information about POPs to the general public within and outside formal education system. Parties should also train key stakeholders like scientists, educators, local leaders and social workers to facilitate the education and awareness programmes for POPs. The awareness should also incorporate the private sector to promote free information sharing about POPs and related activities. When the aforementioned are implemented, it is easier to evaluate the effectiveness of the Convention.

From the analysis of POPs Inventory carried out in 2014, there is limited public awareness and education on issues related to POPs and their management among the policy and decision makers, regulators and the general public. This has resulted into inadequacy in establishment of POPs management plans and systems in the country.

There have been previous efforts to raise awareness on POPs and other chemical related multilateral environmental agreements among district level technical staff and representatives of high school chemistry teachers under the regional project entitled: *'Capacity Strengthening and Technical Assistance for the Implementation of Stockholm Convention National Implementation Plans (NIPs) in African Least Developed Countries (LDC)*' From the workshop, it was observed that information on Stockholm Convention on POPs, their effects and life cycle is not known to the participants. Additionally, the school curriculum does not include specific topics related to multilateral environmental agreements.

There is, therefore, a need for a widerscale sensitization and education at all levels of the population including policy makers, regulators, and the general population.

CHAPTER THREE

3.0 STRATEGY AND ACTION PLAN ELEMENTS OF THE NIP

This chapter has two elements: a formal policy statement and the implementation strategy for the NIP. The implementation strategy sets out specific action plans or strategies to achieve Convention obligations as set by Uganda.

3.1 Policy statement

The government of Uganda is committed to addressing POPs issues. As a result, government acceded to the Stockholm Convention and produced its first NIP in 2008. This revised NIP systematically demonstrates how POPs management will be mainstreamed in government policies and the National Development Plan. In the spirit of mainstreaming POPs issues, Government adopts and endorses this NIP; it will be reviewed and updated periodically to ensure that it remains effective.

3.2 Implementation strategy

The diagnosis of the existing situation in Uganda on the basis of available data is an essential element for taking proper measures aiming at successful implementation of the provisions of the Stockholm Convention.

The implementation strategy for the NIP has been built on three main considerations:

(i) Reviewing, evaluating and updating of the NIP.

(ii) Building technical capacity and strengthening the institutions that will be involved in implementation of the NIP.

(iii) Appropriate prioritizing of the actions planned.

The priority areas under the revised NIP for Uganda are based on the findings of the national POPs inventory process, stakeholder Priority Setting, Action Planning and NIP development Workshops held in 2015. The revised NIP identified and prioritised eight strategic areas of intervention, and these are:

1. Phase out of use of Endosulfan as an agricultural pesticide and identification of cost effective alternatives.
2. Development of national awareness creation and educational programmes on the effects of POPs and other hazardous chemicals on human health and the environment.
3. Strengthening of the regulatory framework and institutional capacities for the management of POPs and other chemicals.
4. Reduction of emissions and releases of PBDEs and PCBs through ESM of wastes in Electrical and Electronic Equipment (WEEE); End of Life Vehicles (ELVs) and PCB contaminated transformer oils and equipment.
5. Introduction of cleaner management practices for products, articles and wastes containing PFOS and other hazardous chemical wastes.
6. Reduction of emission and releases of unintentionally produced POPs from dumpsites, open opening of wastes, metal production processes, waste incineration amongst others.

7. Enhancement of research and monitoring programmes for POPs and other hazardous chemicals.
8. Introduction of environmentally sound management practices for POPs contaminated sites and equipment.

It is therefore, envisaged that the NIP for Uganda will be implemented through a multi stakeholder approach, with emphasis to mainstream the proposed actions into the various sectoral plans and budgets. NEMA will continue to coordinate the implementation of the NIP while seeking financial and technical support from international partners.

3.3 Activities, strategies, and action plans

A detailed action plan below in Table 28 summaries all the strategic areas of inventions, the activities for each prioritized strategy and the action plans.

Table 28: Detailed action plan for the management of POPs (2016 -2025)

STRATEGIC AREA FOR INTERVENTION - 1: Phase out of Endosulfan								
Strategic Objective	**Expected Outputs**	**Activities**	**Strategies**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To eliminate the use of endosulfan and promote adoption of cost effective alternatives.	Importation and use of endosulfan phased out	Apply for exemption from the Stockholm Convention Secretariat for specific pest-crop complexes for the phase out period.	Complete exemption form for specific crop -pest complexes	2016 - 2018			MAAIF/Crop Protection Department, NEMA,	6,666.66
		Undertake regulatory actions for phase-out of importation and use of endosulfan	Facilitate meetings of the Agricultural Chemicals Board (ACB)	2016 - 2018	2019 - 2021	2022 – 2025	MAAIF/Crop Protection Department, NEMA,	13,333.34
			Facilitate meetings of Agricultural Chemicals Control Technical Committee (ACCTC)	2016-2018	2019 - 2021	2022 – 2025	MAAIF/Crop Protection Department, NEMA,	13,333.34
			Facilitate consultative meetings with Stakeholders e.g. Agriculture officers, farmers, Importers, extension officers, agrochemical dealers, Institutions, facilitators etc. at various levels	2016-2018	2019 - 2021	2022 – 2025	MAAIF/Crop Protection Department, NEMA, Agro Chemical Dealers' Associations, Farmers	1,166,666.66
			Degazette importation and use of endosulfan Enforce compliance among importers and users of endosulfan	2016 - 2018	2019 - 2021		MAAIF/Crop Protection Department, NEMA,	26,666.66
		Enforce compliance among importers and users of endosulfan	Facilitate inspectors to ensure compliance	2016 - 2018	2019 - 2021	2022 – 2025	MAAIF/Crop Protection Department, NEMA, Agro Chemical Dealers' Associations, Farmers	133,333.34

	Expected Outputs	Activities	Strategies	Time Frame			Responsibility	Total cost (USD)
				Short term	Medium term	Long term		
	Cost effective alternatives promoted and adopted	Identify , assess, adopt and promote cost alternatives	Screening and ranking studies to identify alternatives to endosulfan	2016 - 2018			MAAIF/Crop Protection Department, NEMA, Agro Chemical Dealers' Associations, Farmers	13,333.34
			Identify sites contaminated by endosulfan and establish ESM measures Pilot field trials for specific crop-pest complexes	2016 - 2018	2019 - 2021	2022 – 2025	MAAIF/Crop Protection Department, NEMA, Agro Chemical Dealers' Associations, Farmers	16,333.34
			Promote use of the feasible and cost effective alternatives Create targeted awareness on the phase out of endosulfan and phase in of alternatives	2016 - 2018	2019 - 2021	2022 – 2025	MAAIF/Crop Protection Department, NEMA, Agro Chemical Dealers' Associations, Farmers	246,666.60
SUB TOTAL								**1,636,333.28**

STRATEGIC AREA FOR INTERVENTION - 2: Information, Public Awareness and Education								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To raise national awareness and develop educational programmes on hazardous chemicals and waste, including POPs for key stakeholders and the general public	Awareness and participation in management of hazardous chemicals and wastes, including POPs, increased.	Design and implement targeted awareness raising strategies for all relevant stakeholders (decision makers, policy makers, local governments, community leaders, industry, informal sectors, women and youth group associations, NGOs, etc.)	Develop Information, Education and Communication(IEC) materials for different target groups (schools, policy makers, technocrats, vulnerable groups, general public) Carry out Community survey to identify issues. Describe target groups. Design, produce and disseminate IEC Material.	2016-2018			NEMA, ,MOH /NDA, MAAIF,MTIC, CSOs	666,666.60
		Conduct awareness raising campaigns for the different target groups	Develop training materials on ESM of POPs for all relevant stakeholders produced and distributed including training materials for use in existing school curricula; Implement training programmes for all relevant stakeholders including higher education; Establish demonstration sites. Package POPs information for media consumption.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, ,MOH /NDA, MAAIF,MTIC, CSOs	666,666.60

STRATEGIC AREA FOR INTERVENTION - 3: *strengthen the regulatory, institutional and policy frameworks for the management and monitoring of POPs and other chemicals.*

	Expected Outputs	Activities	Tasks	Time frame			Responsibility	Total Cost (USD)
				Short term	Medium term	Long term		
	Information on POPs and other hazardous chemicals readily available to all stakeholders	Develop a database (information) on POPs and POP containing materials for use by the targeted groups	Compile information. Train users of the database. Maintain office for regular updates. Design and maintain the database.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA	2,000,000.00
		Establish web-based portal on ESM of POPs and technology transfer.	Design and maintain office for regular updates	2016 - 2018	2019 - 2021	2022 - 2025	NEMA,	200,000.00
	Integrated educational programmes with appropriate information on POPs and other hazardous chemicals developed	Develop educational curriculum for POPs and other hazardous chemicals for different educational levels (primary, secondary and tertiary)	Conduct a situation analysis to identify gaps in the current curriculum in consultation with key stakeholders. Incorporate POPs, hazardous chemicals and waste management into the existing curriculum. Design training materials	2016 - 2018			NEMA, MoES, MTIC MLGSD	200,000.00
		Develop tailored training programmes on POPs and other hazardous chemicals	Training teachers. Review existing programmes. Develop modules for different groups. Conduct TOTs. Facilitate trainings	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MoES, MTIC MLGSD	1,000,000.00
SUB TOTAL								**4,733,333.20**

Strategic Objective	Expected Outputs	Activities	Tasks	Time Frame			Responsibility	Total cost
				Short term	Medium term	Long term		(USD)
To strengthen the regulatory, institutional and policy frameworks for the management and monitoring of POPs and other chemicals.	Regulations / legislations for ESM of POPs finalised and operationalised;	Finalize the amendment of the National Environment Act to provide for the domestication of the Stockholm Convention as well as broad provisions for the management of POPs	Hold Consultative meetings	2016 - 2018			NEMA; MWE; JLOS, Cabinet, Parliament, STAKEHOLDERS, DLGs,	133,333.36
		Finalize the draft Regulations on Sound Management of Chemicals to provide for the management of POPs through its life cycle	Hold Consultative meetings	2016 - 2018			NEMA; MWE; JLOS, Cabinet, Parliament, STAKEHOLDERS, DLGs,	133,333.36
		Finalize drafting the Agricultural Chemicals (Pesticide Registration) Regulations, 2015, the Agricultural Chemicals (Fertilizer) Regulations, 2015 and the Agricultural Chemicals (Application equipment) Regulations 2015	Hold Consultative meetings	2016 - 2018			NEMA; MWE; JLOS, Cabinet, Parliament, STAKEHOLDERS, DLGs,	133,333.36
		Build stakeholder consensus on roles and responsibilities within the law	Undertake advocacy actions. Hold Consultative meetings	2016-2018			NEMA; MWE; JLOS, Cabinet, Parliament, STAKEHOLDERS, DLGs,	160,000.00

		Activities	Tasks	Short-term	Medium term	Long term	Responsibility	Total Cost (USD)
		Promote integration (mainstreaming) of sound chemical management in plans, programmes, of government institutions. Develop sectoral policies for meantsreaming POPs issues in national socioeconomic development programmes, plans or projects	Develop guidelines. Conduct ToTs workshops. Hold Policy dialogues	2016 - 2018			NEMA; MWE; JLOS, MFPED, MDAs, Cabinet, Parliament, STAKEHOLDERS, DLGs.	586,666.64
		Coordinate the formulation & implementation of ordinances and by-laws to address POPs issues at LG level	Engage LGs in undertaking revision and developing ordinances. Train LGs	2016 - 2018			NEMA; MWE; JLOS, Cabinet, Parliament, STAKEHOLDERS, DLGs,	333,333.36
	Legal and regulatory framework operationalized	Legally establish and operationalize a Multi-Stakeholder Technical Committee on Chemicals Management in the NEA and the Regulations on Sound Management of Chemicals	Develop TORs for the committee. Establish the secretariat	2016 - 2018			2015 -2018	800,000.00
	Capacity of NEMA to effectively monitor and coordinate sound management of POPs, other hazardous chemicals and wastes strengthened	Operationalize the database and a clearing house mechanism for POPs and other hazardous chemicals.	Facilitate regular meetings of multi-sectoral technical committee.	2016 - 2018	2019-2020		NEMA	1,333,333.36
			Develop a knowledge management guide	2016 - 2018			NEMA	80,000.00
			Assign staff to manage the database and the clearing house.	2016 - 2018			NEMA	432,000.00

		Activities	Tasks	Short term	Medium term	Long term	Responsibility	Total Cost (USD)
		Signing MOUs between NEMA and MDAs to enhance collaboration on implementation of cross-cutting activities	Hold Consultative meetings	2016 - 2018	2019-2020		NEMA, MDAs	26,666.64
		Mobilize financial resources for management of POPs and other hazardous chemicals	Develop a financing strategy for management of POPs and hazardous chemicals. Assign responsibility for resource mobilization	2016 - 2018			NEMA	80,000.00
			Hold Consultative meetings	2016 - 2018			NEMA, relevant Stakeholders	26,666.64
	Capacity of URA Customs to identify banned and restricted chemicals and POP-containing articles enhanced	Carry out trainings (identification, segregation and registration of chemicals)	Develop a reference manual	2016 - 2018			NEMA, UNBS, URA	200,000.00
		Develop a standard operating procedure (SOP)	Hold Consultative meetings (National Coordination Committee and URA). Designing the SOP.	2016 - 2018				160,000.00

Strategic Objective	Expected Outputs	Activities	Tasks	Short term	Medium term	Long term	Responsibility	Total Cost (USD)
	Capacity of Ministry of Trade, Industry and Cooperatives (MTIC) to effectively support sound management of POPs and other hazardous chemicals enhanced	Conduct capacity building programmes for MTIC staff on management of POPs and other hazardous chemicals.	Develop training modules. Train staff	2016-2018			NEMA, MTIC	133,333.36
		Promote cleaner production technologies	Collate materials on cleaner production technologies	2016 - 2018			NEMA, MTIC	66,666.64
			Hold Consultative meetings	2016 - 2018			NEMA, MTIC	426,666.64
			Develop and Implement a feedback mechanism between industries and National Coordination committee	2016 - 2018			NEMA, MTIC	40,000.00
	Collaboration and partnership on laboratory capacity and research on POPs and other hazardous chemicals management promoted	Signing MOUs between NEMA and other institutions to collaborate on laboratory capacity and research on POPs and other hazardous chemical management	Identify relevant Institutions. Draft MOUs.	2016 - 2018			NEMA	26,666.64
		Periodic review of progress and status of activities within the MOU	Develop Periodic reports.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA	93,333.36
SUB TOTAL								**5,405,333.36**

STRATEGIC AREA FOR INTERVENTION - 4: Proper management of Products, articles, and wastes containing PBDES, PCBs and other hazardous chemicals								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To reduce emission and releases of PBDEs and PCBs through ESM of wastes in electrical and electronic equipment (WEEE); end-of life vehicles (ELVs) and PCB contamonated transformer oils and equipments	Products containing PBDEs, PCBs and other hazardous chemicals profiled.	Conduct comprehensive inventories of articles and products containing PBDEs, PCBs and other hazardous chemicals Develop WEEE and ELVs management strategies including exploration of innovative business approaches such as PPP mechanism;	Eliminate the use of PCBs in electrical transformers by Hire consultants. Hold consultative meetings	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MITC	1,777,777.60
		Create a database of articles containing PBDEs, PCBs and other hazardous chemicals	Hire Consultant. Carry out stakeholder consultations	2016 - 2018			NEMA, MITC	133,333.00
		Regularly update the database	Profile information.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MITC	222,222.40

	Expected Outputs	Activities	Tasks	Time frame			Responsibility	Total cost (USD)
				Short term	Medium term	Long term		
	Articles and their wastes containing POPs- PBDEs, , PCBs and other hazardous chemicals properly managed and disposed	Promote segregation of the different categories of waste from ELVs at designated areas in line with developed guidelines and regulations Decommission all residual PCB electrical transformers by 2022 Establish interim storage facility for solid and liquid waste consisting of and/or contaminated with PCBs by 2017 Promote measures to reduce exposure and risks to PCB oils and PCB contaminated equipment.	Designate licensed yards for ELVs collection, dismantling, recovery of reusable parts selected and disposal strategies of related wastes developed; Develop guidelines Train stakeholders.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA	6,666,666.60
		Demonstrate BAT/BEP for ESM of whole lifecycle of WEEE in existing facilities and infrastructure; train relevant stakeholders and facility workers based on the	Designate a place with environmental safeguards. Set up facilities. Recruit and train staff.	2016 - 2018			NEMA, MITC	8,000,000.0

		Basel Convention ESM guidelines and other relevant guidance. Put in place collection, dismantling, and handling facilities for Electrical and Electronics end-of-life products.	Develop technical guidelines.					
		Promote appropriate handling of POP-containing end-of-life products and take-back (extended producer responsibility) programmes for collecting unwanted EEEs for recycling.	Enhance Capacity of local governments, private and informal sectors to effectively ensure ESM of WEEE and ELVs. Develop guidelines including BAT/BEP. Engage the producers or importers (traders). Operationalize guidelines. Promote take back programmes for collecting unwanted EEEs for recycling	2016 - 2018			NEMA, MITC	1,417,778.00
		Promote establishment of proper waste disposal and treatment facilities to prevent environmental contamination	Develop guidance on proper waste disposal. Set up sanitary incineration facilities. Undertake environmental safeguards for these facilities. Engage private sector and/or other partners	2016 - 2018			NEMA	977,777.00

		Activities	Tasks	Short term	Medium term	Long term	Responsibility	Total cost
		Profile POP-containing wastes and promote their sorting from general wastes at source of generation	Develop guidelines (including BAT/BEP); Training stakeholders	2016 - 2018			NEMA	977,777.00
	Risk arising from the importation of articles and products containing POPs- PBDEs,, PCBs and other hazardous chemicals reduced	Promote use of information on product CAS numbers, clear labeling and cross-checking for import of articles containing hazardous chemicals	Hold Consultative meetings with stakeholders. Develop national standards with CAS requirements. Develop guidelines for stakeholders.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, Local Government, Research Institutions	977,777.60
		Promote the production and importation of alternative articles and products which do not contain POPs-PBDEs, PCBs and other hazardous chemicals	Establish standards on recommended limits for PBDEs, PCBs and	2016-2018	2019 - 2021	2022-2025	NEMA, URA, UNBS, MTIC, MoFA, Universities and research institutes	1,466,666.60
			Disseminate the information to key stakeholders	2016 - 2018			NEMA	222,222.40
		Undertake risk assessment studies on chemicals in the leachate from waste collection sites and landfills to establish if they pose any risks to human health and environment.	Hire consultants.	2016-2018			NEMA	1,777,777.73
SUB TOTAL								**24,617,775.93**

STRATEGIC AREA FOR INTERVENTION - 5: Proper management of Products, articles, and wastes containing PFOS								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To properly manage products, articles and wastes containing PFOS,	Products containing PFOS profiled	Conduct comprehensive inventories of articles and products containing PFOS	Hire consultants. Hold consultative meetings	2016 - 2018			NEMA, MITC	888,889
		Create a database of articles containing PFOS	Hire Consultant. Carry out stakeholder consultations	2016 - 2018			NEMA, MITC	66,667
		Regularly update the database	Profile information.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MITC	111,111
	Articles and their wastes containing PFOS properly managed and disposed	Promote appropriate handling of obsolete stockpiles	Develop guidelines including BAT/BEP. Engage the producers or importers (traders). Operationalize guidelines.	2016 - 2018			NEMA, MITC	488,889
		Promote establishment of proper waste disposal and treatment facilities to prevent environmental contamination	Develop guidance on proper waste disposal. Set up waste incineration facilities. Undertake environmental safeguards for these facilities. Engage private sector and/or other partners	2016 - 2018			NEMA	488, 889

		Activities	Tasks	Short-term	Medium term	Long term	Responsibility	Total Cost (USD)
		Profile POP-containing wastes and sort them from general wastes at source of generation	Develop guidelines (including BAT/BEP); Training stakeholders	2016 - 2018			NEMA	488,889
	Risk arising from the importation of articles and products containing PFOS, reduced	Promote use of information on product CAS numbers, clear labelling and cross-checking for import of articles containing hazardous chemicals	Hold Consultative meetings with stakeholders. Develop national standards with CAS requirements. Develop guidelines for stakeholders.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, Local Government, Research Institutions	488,889
		Promote the production and importation of alternative articles and products which do not contain PFOS	Establish standards on recommended limits for PFOS;	2016 - 2018	2019 - 2021	2022-2025	NEMA, URA, UNBS, MTIC, MoFA, Universities and research institutes	488,889
			Disseminate the information to key stakeholders	2016 - 2018			NEMA	111111
		Undertake risk assessment studies on chemicals in the leachate from waste collection sites.	Hire consultants.	2016-2018			NEMA	888,888.87

	Expected Outputs	Activities	Tasks	Short term	Medium term	Long term	Responsibility	Total Costs (USD)
	Improved management of the PFOS contained in Stocks of Fire Fighting Foams (FFF); contaminated sites where FFF were applied in the past and the waste of their chemical products	Require companies that hold stocks of fire-fighting foams to declare the amount of stockpiles and report activity of use, disposal and accidental spills to regulatory authorities Remediate contaminated sites where FFF was applied in the past	Develop a feedback mechanism. Training the FFF users. Record Keeping	2016-2018			NEMA	333,333.40
SUB TOTAL								**4,355,556.27**

STRATEGIC AREA FOR INTERVENTION - 6: Reduction of UPOPs emission and releases								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To reduce emissions and releases of UPOPs from major sources.	Emissions of UPOPs from major sources reduced	Identify the major emitting sources in Uganda	Hire consultant	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MOH /NDA, MTIC	420,000.00
		Adopt the appropriate BAT/BEP using the Stockholm Convention toolkit for Dioxins and Furans	Introduce BAT/BEP in municipal solid waste management to reduce emissions of UPOPS from open burning Introduce BAT/BEP for a cleaner management of medical waste Introduce BAT/BEP in ferrous and non-ferrous metal production. Training stakeholders; Set up demonstrations;	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MOH /NDA, MTIC	910,000.14
		Monitoring of UPOPs in environmental matrices at/near the source points	Collect samples. Carryout Laboratory analysis of the samples. Report the findings	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MOH /NDA, MTIC	2,659,999.86
SUB TOTAL								**3,990,000.00**

STRATEGIC AREA FOR INTERVENTION -7: Research, Development and Monitoring								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To establish a research and monitoring programme for hazardous chemicals and waste, including POPs	A programme for monitoring levels of POPs, hazardous chemicals and their transformation products in the environment operationalized	Design the monitoring programme	Constitute a technical committee	2016 -2018	2019 - 2021	2022 - 2025	NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	20,000.00
			Hold Consultative meetings	2016 -2018	2019 - 2021	2022 - 2025	NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	66,666.66
			Endorse the programme	2016 -2018	2019 - 2021	2022 - 2025	NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	23,333.34
		Identify partners to monitor POP levels in air, human blood, human milk and water	Profile the existing capacity of potential partners	2016 -2018			NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	43,333.34
			Develop criteria for selection of suitable partners	2016 -2018			NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	6,666.66
			MOUs with partner institutions	2016 -2018			NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	6,666.66

Strategic Objective	Expected Outputs	Activities	Tasks	Short term	Medium term	Long term	Responsibility	Total Cost (USD)
To establish a research and monitoring programme for hazardous chemicals and waste, including POPs		Enhance the capacity of participating laboratories of partner institutions	Training (refresher training at an advanced laboratory)	2016 -2018	2019 - 2021		NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	43,333.34
			Boost capacity of laboratory to undertake analysis	2016 -2018	2019 - 2021		NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	1,000,000.00
	National programme on monitoring compliance by stakeholders implemented	Design the monitoring and compliance programme	Constitute a technical committee	2016 -2018			NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	23,333.34
			Hold Consultative meeting	2016-2018			NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	23,333.34
			Endorse the programme	2016 -2018			NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	23,333.34
		Train and equip field inspectors	Hold Training Workshops.	2016 -2018	2019 - 2021		NEMA, Academia, Research Institutes ,MOH /NDA,MAAIF, MTIC, MWE, and CSOs	53,333.34
SUB TOTAL								**1,333,333.36**

STRATEGIC AREA FOR INTERVENTION - 8: Management of Contaminated sites, Remediation and Restoration								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost (USD)**
				Short term	**Medium term**	**Long term**		
To improve the management of POP-contaminated sites and equipment	Contaminated sites mapped	Detailed assessment and analysis of identified contaminated sites;	Hire consultant	2016 - 2018			NEMA, MAAIF,MOH/ NDA, MTIC, MWE and CSOs	20,000.00
		Map the size of contaminated sites	Hire consultant. Procure mapping and sampling Equipment	2016 - 2018			NEMA, MAAIF,MOH/ NDA, MTIC, MWE and CSOs	36,666.66
	Contaminated sites assessed and prioritized	Determine the extent of POP-contamination at these sites	Collect samples from the sites. Carry out Laboratory analysis of the samples. Report findings	2016 - 2018	2019 - 2021		NEMA, MAAIF, Academic Institutions, and other stakeholders	23,333.34
	Contaminated sites remediated	Cordon off the area and install warning notices	Procure materials. Provide security for the cordoned areas.	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MAAIF ,MOH/ NDA, MTIC, MWE and CSOs	313,333.34
		Restoration and remediation of selected contaminated sites.	Conduct research to find appropriate remediation/restoration technology	2016 - 2018	2019 - 2021	2022 - 2025	NEMA, MAAIF ,MOH/ NDA, MTIC, MWE and CSOs	43,333.34
SUB TOTAL								**436,666.68**

NIP MANAGEMENT AND MONITORING COSTS								
Strategic Objective	**Expected Outputs**	**Activities**	**Tasks**	**Time Frame**			**Responsibility**	**Total cost**
				Short term	**Medium term**	**Long term**		**(USD)**
To ensure that project goals and objective are achieved and to improve performance.	Periodic monitoring and evaluation of NIP activities implemented	Conduct project annual evaluation	Review project reports. Carryout field visits	2016-2018	2019 - 2021	2019 - 2021	NEMA	23,333.34
		Conduct Midterm evaluation of NIP activities	Review project reports. Carryout field visits		2019 - 2021		NEMA	11666.67
		Conduct Final evaluation of NIP activities	Review project reports. Carryout field visits			2019 - 2021	NEMA	11666.67
	Funding mobilization stategy (business plan) developed	Develop a Funding mobilization strategy (business plan)	Organise a donor workshop Create a section within NEMA to manage NIP implementation Hold regulator stakeholder coordination meetings Organise a donor workshop Communicate the progress of implementation of the NIP	2016-2018				23,333.34
	Administrative Costs provided	Provide all the necessary facilitation for the project	Procure Project Vehicle, Communication Facilities, Office equipment, Travel costs	2016-2018	2019 - 2021	2019 - 2021	NEMA	4,591,999.96
SUB TOTAL								**4,661,999.98**
GRAND TOTAL								**50,730,332.86**

3.4 Progress in Implementing Stockholm Convention in Uganda

Through a five year regional project (2011-2016) '*Capacity Strengthening and Technical Assistance for the Implementation of Stockholm Convention National Implementation Plans (NIPs) in African Least Developed Countries (LDCs)*', Uganda has implemented some of the priority areas of actions recommended in the first NIP:

a) POPs and other chemical management aspects into the revised National Environment Act (now a Bill).

b) Preparation of draft sound chemical management regulations including POPs issues. The regulation, however, is still in draft form and awaits finalization and operationalization.

c) Raising awareness of POPs and other chemical related multilateral environmental agreements among district level staff. Of course there is still need for wider scale awareness raising campaigns and trainings among all levels of the population.

d) Building national capacity to identify and assess POPs contaminated sites.

e) Initiation of action to establish a national network for chemical information exchange.

Uganda participated in the first phase of the project, 'Supporting the Global Monitoring Plan on POPs in the Eastern and Southern African region'. The project built capacity of staff at Directorate of Governmental Analytical Laboratory (DGAL) in analysis of POPs in human milk and monitoring of POPs in air was built. A second phase of the project will soon be launched. Private electricity companies like UMEME have made efforts to eliminate PCB emissions from transformer oils by replacing PCB contaminated transformers with PCB-free transformers. Additionally, since releases of unintentional POPs from medical incinerators was among priority areas of action in the first NIP, a Non-governmental organization, PROBICO in collaboration with Mengo hospital, Located in Kampala city, piloted a project on "*Non-incineration Health Care Waste Management technologies.* The project aimed at minimizing the releases of dioxins and furans from incineration, improving health-care waste management system at Mengo Hospital and facilitated the development of a recycling system for plastics and other recyclable waste.

Since the completion of her first NIP, Uganda has actively participated in the global negotiation meetings and Conference of Parties that are held after every two years.

3.5 Resource requirements

This is a ten (10) year action plan, to be implemented, from 2016- 2025. The activities in the plan have been scheduled as, short-term (2016 – 2018); Medium term (2019-2021) and long-term (2022-2025). The total estimated financial requirements for the implementation of the priorities areas of action for a ten year period are $ **50,730,332.86.**

Table 29: Summarized strategic areas of intervention, action areas and estimated budgets

Strategic Objectives	Action areas	Estimated budget (USD)
1.To eliminate the use of endosulfan and promote adoption of cost-effective alternatives.	(i) Apply for exemption for specific crop-pest complexes; (ii) Create targeted awareness on the phase out of endosulfan and phase in of alternatives (iii) Undertake regulatory action for phase out of importation and use of endosulfan in agriculture; (iv) Enforce compliance among importers and users of endosulfan (v) Identify, assess, adopt and promote cost effective alternatives to endosulfan (vi) Identify sites contaminated by endosulfan and establish ESM measures	**1,636,333.28**
2. *To raise national awareness and develop educational programmes on hazardous chemicals and waste, including POPs for key stakeholders and the general public*	(i) Design and implement a targeted awareness programme for all relevant stakeholders (decision makers, policy makers, local governments, community leaders, industry, informal sectors, women and youth group associations, NGOs, etc.) (ii) Develop training materials on ESM of POPs for all relevant stakeholders produced and distributed including training materials for use in existing school curricula; (iii) ;Establish web-based portal on ESM of POPs and technology transfer.	**4,733,333.20**
3. *To strengthen the regulatory, institutional and policy frameworks for the management and monitoring of POPs and other chemicals.*	(i) Finalise and operationalise regulations / legislations for ESM of POPs; (ii) Legally establish and operationalise Multisectoral Technical Committee for Chemicals Management; (iii) Enhance capacities of key institutions and agencies in coordinating , monitoring, analysis and management of POPs. (iv) Develop sectoral policies for meantsreaming POPs issues in national socioeconomic development programmes, plans or projects	**5,405,333.36**
4. To reduce emission and releases of PBDEs and PCBs through ESM of wastes in electrical and electronic equipment (WEEE); end-of life vehicles (ELVs) and PCB contaminated transformer oils and equipment	(i) Develop WEEE and ELVs management strategies including exploration of innovative business approaches such as PPP mechanism; (ii) Demonstrate BAT/BEP for ESM of whole lifecycle of WEEE in existing facilities and infrastructure; train relevant stakeholders and facility workers based on the Basel Convention ESM guidelines and other relevant guidances; (iii) Designate centers for WEEE segregation, storage and recycling / recovery of valuable parts and develop disposal strategy for PBDEs containing wastes. (iv) Designate licensed yards for ELVs collection, dismantling, recovery of reusable parts selected and disposal strategies of related wastes developed; (v) Enhance Capacity of local governments, private and informal sectors to effectively ensure ESM of WEEE and ELVs.	

Strategic Objectives	**Action areas**	**Estimated budget (USD)**
4. *To reduce emission and releases of PBDEs and PCBs through ESM of wastes in electrical and electronic equipment (WEEE); end-of life vehicles (ELVs) and PCB contaminated transformer oils and equipment*	(vi) Eliminate the use of PCBs in electrical transformers by 2025; (vii) Decommission all residual PCB electrical transformers by 2022 (viii) Establish interim storage facility for solid and liquid waste consisting of and/or contaminated with PCBs by 2017 (ix) Promote measures to reduce exposure and risks to PCB oils and PCB contaminated equipment.	**24,617,775.93**
5. To *Properly manage products, articles and wastes containing PFOS and other hazardous chemical wastes.*	(i) Profile products containing PFOS; (ii) Ensure proper management and disposal of articles and wastes containing PFOS; (iii) Reduce risk arising from the importation of articles and products containing PFOS; (iv) Improved management of the PFOS contained in Stocks of Fire Fighting Foams (FFF); (v) Remediate contaminated sites where FFF was applied in the past	**4,355,556.27**
6. *To reduce emissions and releases of UPOPs from major sources.*	(i) Introduce BAT/BEP in municipal solid waste management to reduce emissions of UPOPS from open burning (ii) Introduce BAT/BEP for a cleaner management of medical waste (iii) Introduce BAT/BEP in ferrous and non-ferrous metal production.	**3,990,000.00**
7. *To establish a research and monitoring programme for hazardous chemicals and waste, including*	(i) Establish a programme for monitoring levels of POPs, hazardous chemicals and their transformation products in the environment in order to participate in the Global Monitoring Plan for effectiveness evaluation (Article 16); (ii) Enhance the laboratory capacity of participating partner institutions; (iii) Design and implement monitoring and compliance programme.	**1,333,333.36**
8.*To improve the management of POP-contaminated sites and equipment*	(i) Detailed assessment and analysis of identified contaminated sites; (ii) Restoration and remediation of selected contaminated sites.	**436,666.68**
NIP management and Monitoring Costs	a) Create a section within NEMA to manage NIP implementation b) Hold regulator stakeholder coordination meetings. c) carry out periodical Internal reviews and evaluations d) Develop a Funding mobilization strategy (business plan) Organise a donor workshop e) Communicate the progress of implementation of the NIP f) Carry of mid-term evaluation	**4,661,999.98**
Grand Total		**50,730,332.86**

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ANNEXES

Annex 1: NATIONAL COORDINATION COMMITTEE MEMBERS

SN	NAME	TITLE	ORGANISATION	EMAIL	PHONE NUMBER
1	Angella Rwabitomize Matsiko	Senior Economist and Sector Officer of Water and Environment	Ministry of Finance, Planning & Economic Development Plot 2/12 Apollo Kaggwa Road P.O.Box 8147 **KAMPALA.**	angella.rwabutomize@finance.go.ug	+256-752537988, +256-414707000, +256-414232095
2	Dr. John Wasswa	Senior Lecturer	Department of Chemistry, College of Natural Sciences, Makerere University Main Campus, JICA Building (Opp. Main Library), University Road. P.O Box 7062, **KAMPALA.**	jnwasswa@cns.mak.ac.ug	+256-772504657, +256-414540985
3	Emmanuel Kaye	Senior Government Analyst	Directorate Government Analytical Laboratories, Ministry of Internal Affairs, Plot 2 Lourdel Road, P.O Box 2174, **KAMPALA**	ekaye50@yahoo.com	+256-776741000 +256-414250474 +256-414250207
4	Fauza Namukuve	Environment Officer	Department of Environment Affairs, Ministry of Water and Environment, P.O.Box 20026 Luzira, **KAMPALA.**	nfauzia2001@yahoo.co.uk	+256-782572362
5	John Mwanja	Senior Agricultural Inspector - Pesticide Inspection	Crop Protection Department, Ministry of Agriculture, Animal Industry and Fisheries. P.O. Box 102. **ENTEBBE**	mwanjajohn@yahoo.com	+256-703103882
6	Kassim Semanda	Engineer department of industry and technology	Ministry of Trade, Industry and Cooperatives, Farmers' House, Parliamentary avenue, P.O. Box 7103, **KAMPALA**	bobs2004kassim@yahoo.com skassim@mtti.go.ug	+256-712189137 +256-703028929

7	Mubaraka Kirunda Nkuutu	Director	Membership Services, Uganda Manufacturers Association, Lugogo Show Grounds, P.O box 6966, **KAMPALA**	directormembership@uma.or.ug	+256-752623443
8	Pauline Akidi	Principal Economist/Head, Multilateral Section,	Aid Liaison Department, Ministry of Finance, Planning & Economic Development, Plot 2/12 Apollo Kaggwa Road, P.O.Box 8147, **KAMPALA.**	Pauline.Akidi@finance.go.ug, paulineakidi@gmail.com	+256-414 707184, +256-772462254.
9	Robert Tumwesigye	Executive Director	Pro Biodiversity Conservationists in Uganda, Plot 181, Bombo Road, Crown House, Building (Ku-Biiri), P.O.Box 21294, **KAMPALA.**	tumwesigyeus@yahoo.com	+256-782393912
10	Silver Ssebagala	Director	Uganda Cleaner Production Center. Plot 42A Mukabya Road. P.O. Box 34644, **KAMPALA**	silverssebagala@yahoo.com	+256-774647363
11	Wilbur Nsiyona Bukosa	Customs Officer	Compliance Unit│ C&BA Division│Customs Department, Uganda Revenue Authority, 9th Floor Plot 17, Crested Towers, Hannington Road **KAMPALA**	wnsiyona@ura.go.ug	+256-772402375
12	Susan Okodi	Foreign Service Officer	Department of Multilateral Organizations and Treaties,Ministry of Foreign Affairs, 2A/B Apollo Kaggwa Road, P.O.Box 7048, **KAMPALA.**	susan.okodi@gmail.com	+256-756482333 +256-701445591
13	Aziz Mukota	Head of chemistry laboratory	Uganda National Bureau of Standards, Plot M217 Nakawa Industrial Area, P.O.Box 6329 **KAMPALA**	azizmukota@gmail.com	+256-712962692, +256-414505995, +256-414-222369, +256-800133133.

14	Dr. Agaba Edson Friday	Food and Safety Coordinator	National Drugs Authority, Plot 46/48 Lumuba avenue, P. O. Box 23096 **KAMPALA**,	agabafriday@hotmail.com agabaef@nda.or.ug	+256-772691236 +256-414-255665 +256-414347391 +256-414347392
15	Dr. Nsubuga Fred Mangasi	Occupational Physician	Ministry of Gender, Labour and Social Development, Plot 2, Simbamanyo House, P.O. Box 7136 George St, **KAMPALA**	mambaeka@yahoo.com	+256-704126915 +256-712450863 +256-414347854
16	Innocent Ejoru	Principal Policy Analyst	Office of the Prime Minister, Plot 9-11 Apollo Kaggwa Road, P.O. Box 341, **KAMPALA.**	ps@opm.go.ug	+256-754492934, +256-783877363, +256-793631313
17	Aristarco Kasekende	Director Finance and Administration	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, KAMPALA.	akasekende@nemaug.org	+256-772503851
18	Arnold Waiswa Ayazika	Director Environmental Monitoring and Compliance	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA.**	wayazika@nemaug.org	+256-772471139
19	Christine Kasedde	Environment Impact Assessment Officer	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA.**	ckasedde@nemaug.org	+256-774686013
20	Dr. Gerald Sawula Musoke	Deputy Executive Director	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA.**	gsawula@nemaug.org	+256-772574325
21	Fred Onyai	Internal Monitoring and Evaluation Specialist	National Environment Management Authority, Nema House Plot 17/19/21 Jinja Road, P.O Box 22255, **KAMPALA.**	fonyai@nemaug.org	+256-772517303

Annex 2: TASK TEAM LEADERS FOR INVENTORY

NO.	Task	Team Leader
1	Assessment of socio-economic implications of use and reduction of New Persistent Organic pollutants (POPS)	Mr. Moses Masiga Environmental Economist ENR Africa Centre Namugongo, Kira Town Council P.O Box 72287, KAMPALA Email: nomman22@hotmail.com Mob. +256 772563919 / (0)755024851
2	Legislative, Regulatory and Institutional framework for new POP management	Ms. Nancy Awori Senior State Attorney Ministry of Justice and Constitutional Affairs, Amamu House plot 5 PO Box 6848, KAMPALA Email: nancyawori@yahoo.com Tel. +256 772578464
3	Inventory and quantification of Unintentionally Produced Persistent Organic Pollutants (UPOPs)	Dr. James Okot-Okumu, College of Agriculture and Environmental Sciences Makerere University. P.O. Box 7062,KAMPALA Email: jokotokumu@yahoo.com Mob. +256772411460
4	Inventories of New Industrial POPs:Perflouroctane Sulfonic acid (PFOS), its salts and Perflouroctane sulfonyl fluoride (PFOS-F)	Dr. Ananias Bagumire Food Safety Associates Ltd Plot 1099 Block 215 Kondogolo Zone Ntinda Kulambiro, Off Ntinda-Kisasi Road, P.O Box 2244, KAMPALA. Email: A.Bagumire@foodsafetyltd.com / ananiasbagumire@gmail.com Mob.+256772475784 / (0)794475784
5	Inventories of old Industrial POPs: Hexachlorobenzene (HCB) and Polychlorinated biphenyls (PCBs)	Mr. Patrick Isagara Kamanda, Environment Specialist, Uganda National Roads Authority Plot 5, Lourdel Road, Nakasero P.O. Box 28487, KAMPALA Email: patrick.kamanda@unra.go.ug Mob. +256772982900
6	Inventories of New Industrial POPs Hexabromobiphenyl (HBB)and the polybrominated diphenyl ethers (PBDEs) ;	Mr. Emmanuel Kaye Senior Government Analyst, Directorate Government Analytical Laboratories, Ministry of Internal Affairs, Plot 2 Lourdel Road, P.O Box 2174, KAMPALA Email: ekaye50@yahoo.com Mob. +256 776741000
7	Inventories of Old and New POPs Pesticides	Mr. Byantwale. T. Stephen, Assistant Commisioner, Crop Protection Department, Ministry of Agriculture, Animal Industry and Fisheries. P.O. Box 102. ENTEBBE Email: byantwale@gmail.com Mob. +256772513180

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)
NEMA House Plot 17/19/21 Jinja Road
P.O. Box 22255 Kampala Uganda
Tel: +256 -414-251064/5/8
Fax: +256 -414-257521
Email: info@nemaug.org
Website: http://www.nemaug.org

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