Government of Zimbabwe

Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants for Zimbabwe

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Ministry of Environment, Water and Climate

GEF

UNEP

Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants for Zimbabwe

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Foreword

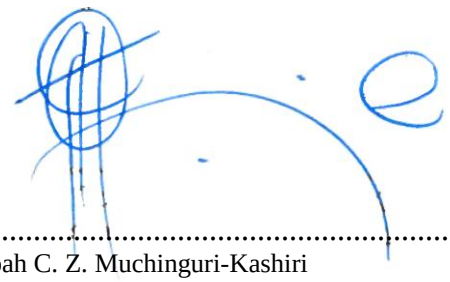
The Government of Zimbabwe is committed to protecting its people and environment from the harmful effects of hazardous chemicals such as Persistent Organic Pollutants (POPs). It has demonstrated this commitment by signing and ratifying the Stockholm Convention on Persistent Organic Pollutants, and making significant strides towards implementing the requirements of the Convention.

Zimbabwe produced its first National Implementation Plan for the Stockholm Convention in 2013, and that initial NIP mainly focussed on the 12 POPs that were initially listed in the Convention. The nation has produced this updated NIP in order to take into account the newly listed POPs such as endosulfan, the brominated flame retardants and perfluorooctane sulfonic acid, which were added to the Convention up to 2013.

The need to update the NIP was critical, as the newly listed POPs are commonly used in Zimbabwe. Endosulfan has been used extensively in agriculture in Zimbabwe, and was only banned for use in 2014, while electronic waste, which contains brominated flame retardants (some of which are POPs) is the fastest growing waste stream in the country, hence there is need to pay particular attention to addressing these POPs. Some of the originally listed POPs, such as the dioxins and furans which arise from uncontrolled combustion, and the Polychlorinated Biphenyls (PCBs) commonly found in transformer oil are still a cause for concern to the country, and need to be reduced and eventually eliminated. The process of updating the NIP could therefore not have come at a better time, as it has enabled the nation to identify the most critical areas that need to be addressed, and has also allowed for the development of specific action plans aimed at reducing the use and / or production of POPs in Zimbabwe.

The Government of Zimbabwe is therefore very pleased to have produced this updated NIP, which will contribute to sustainable development, since the action plans herein are aimed at protecting human health and promoting environmentally sustainable economic growth for the country. The Government will therefore endeavour to ensure that this NIP is implemented, and since the issue of POPs cuts across many sectors, a multi-stakeholder approach will be used to ensure implementation of the NIP.

On behalf of the Government, I wish to express sincere gratitude to the Global Environment Facility (GEF) and the Food and Agricultural Organization of the United Nations (FAO) for sponsoring the NIP Update process, as well as United Nations Environment Programme (UNEP) for implementing this project. I also wish to thank the stakeholders who participated in the production of the NIP, either through participating on the POPs National Coordinating Committee, or carrying out various activities related to the NIP update, or participating in NIP-related workshops. I look forward to continued cooperation in implementing the NIP.



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Hon. Oppah C. Z. Muchinguri-Kashiri

Minister of Environment, Water and Climate

Executive Summary

The National Implementation Plan (NIP) is a guiding document which details how Zimbabwe will meet its obligations under the Stockholm Convention on Persistent Organic Pollutants (POPs). The NIP, which is a requirement under Article 7 of the Convention, identifies Zimbabwe's priority issues concerning POPs, and sets out action plans for addressing the priority issues. Zimbabwe prepared its first NIP in 2013, focusing on the POPs that were originally listed in the Stockholm Convention, and has updated the NIP in order to take into account POPs which have been added to the Convention in recent years.

The Stockholm Convention

The Stockholm Convention (SC) is a global treaty that aims to protect human health and the environment from a group of highly toxic chemicals known as Persistent Organic Pollutants (POPs). POPs are toxic to both humans and the environment. They bio-accumulate in the fatty tissues of living organisms, persist in the environment for long periods before breaking down into less harmful substances, and can travel long distances from where they were originally produced. POPs can be pesticides, industrial chemicals, or unintentionally produced by-products of combustion and other processes. The Stockholm Convention requires parties to take measures aimed at reducing and ultimately eliminating the production and use of POPs. The Convention also requires each party to produce a National Implementation Plan detailing how the party will meet its obligations under the Stockholm Convention.

The NIP Update Process

The process of updating Zimbabwe's NIP was coordinated by the Ministry of Environment, Water and Climate. Guidance and advice for the project were provided by a multi-stakeholder National Coordinating Committee (NCC). The process involved initially conducting POPs inventories and baseline assessments (infrastructure assessment, socio-economic assessment, and assessment of POPs impacts on human health and the environment). From these activities, issues of concern were identified and prioritized, and then action plans for addressing the prioritized issues of concern were developed. Most of these activities were carried out by task teams drawn from various stakeholders. The NIP is structured into three chapters, which are the introductory chapter giving background information on the NIP, the second chapter which is an assessment of Zimbabwe's baseline information, including an assessment of POPs in Zimbabwe, and the third chapter which outlines the prioritized issues and the action plans for addressing the priority issues. The Updated NIP was compiled by the Ministry of Environment, Water and Climate, and it was endorsed by stakeholders at a national workshop on 30 March 2017.

Regulatory Mechanisms for Chemicals and Environmental Management

Zimbabwe has a robust legislative environment for addressing general environmental management issues, but falls short when it comes to addressing specific POPs issues. The main pieces of legislation for environmental management in general, and POPs in particular, are the Environmental Management Act (Chapter 20:27) which provides for the management of general waste, hazardous waste and hazardous substances; the Fertilizer, Farm Feeds and Remedies Act which provides for the registration of pesticides, and the Factories and Works Act which provides for the regulation of conditions of work in the factories. These legal instruments are often not as effective as they could be due to lack of awareness of their existence in certain cases, and insufficient enforcement.

Non-Regulatory Instruments for Chemicals and Environmental Management

There are also non-regulatory mechanisms for environmental and chemicals management. These include environmentally sound technologies (formerly known as, and encompassing Cleaner Production), which employ resource use efficiency to reduce waste, recover materials for reuse, and reduce the emissions of certain chemicals. Other voluntary environmental management mechanisms include systems certification schemes like ISO 14001 offered by the national standards body, Standards Association of Zimbabwe. The ISO 14001 Environmental Management System certification is useful, especially in terms of Polychlorinated biphenyls (PCBs) management, since organizations seeking certification are required to know and record the PCB status of their electrical equipment, specifically power transformers and capacitors.

Relevant International Conventions to which Zimbabwe is Party

Zimbabwe is party to a number of chemicals management related conventions, which include the Stockholm Convention on Persistent Organic Pollutants¸ the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, and the Bamako Convention on the Ban of the Importation into Africa of Hazardous Waste. The country is also a party to the Vienna Convention¸ the Montreal Protocol, the United Nations Framework Convention on Climate Change, the Kyoto Protocol and International Labour Organization (ILO) Convention 170 concerning Safety in the Use of Chemicals at Work. Zimbabwe has signed the Minamata Convention on mercury, but has not yet ratified. For most of the Conventions, an office has been established in the relevant Ministry for administering issues pertaining to the Convention. In some cases, the requirements of the Conventions have been enshrined in local legislation, such as the Vienna Convention through the ban of chlorofluorocarbon (CFC)-emitting substances. In many cases, however, the requirements of the Convention have not yet been enshrined in local legislation, such as the sound management of PCBs and unintentionally produced POPs (U-POPs), hence enforcement of the Convention requirements at a local level poses a challenge, and there is need to domesticate the requirements of the Conventions.

Other National Policies / Plans / Strategies which Contribute to POPs Reduction

In addition to regulatory and non-regulatory instruments for chemicals management, there are a number of national policies / plans / strategies which have been developed for addressing other non-chemicals related issues, but whose implementation will result in reducing POPs usage and production, thus achieving the objectives of the NIP. The policies / plans / strategies include economic, social and environmental ones, and were taken into account in the development of the NIP. The major ones are the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset), the National Environment Policy, the National Climate Change Response Strategy, the National Integrated Waste Management Plan, the National Fire Strategy and Implementation Plan, the National Energy Policy, the National Biodiversity Strategy and Action Plan, the National Energy Policy, and the National Gender Policy.

Roles and Responsibilities of Different Players in Chemicals Management

There are many different players, both Governmental and Non-Governmental, who play important roles in ensuring sound chemicals management. The Government Ministries and departments include the Ministry of Health and Child Welfare in malaria control and chemical analysis of various substances; the Ministry of Agriculture, Mechanization and Irrigation Development in pesticides registration, analysis of pesticides residues and control of animal pests and diseases; Environmental Management Agency which oversees the management of hazardous substances, hazardous waste and general waste and runs an analytical laboratory; the Zimbabwe Electricity Supply Authority which generates and provides electricity for the nation, and thus manages the majority of transformers in the country; the National Social Security Authority which oversees occupational safety and health issues for workers in Zimbabwe; the Zimbabwe Revenue Authority which monitors products

that are imported into country; and the Zimbabwe National Statistics Agency which compiles statistical data for Zimbabwe covering a wide range of thematic areas, including import and export data, employment data, and chemicals usage data.

The Non-Governmental Organizations include the Business Council for Sustainable Development Zimbabwe which encourages commitment by industry to environmentally sustainable business practices; the Standards Association of Zimbabwe which facilitates the development of national standards and encourages their implementation and also offers laboratory services and systems certification; the Confederation of Zimbabwe Industries which acts as the representative voice for the manufacturing industry; the Consumer Council of Zimbabwe which aims to protect consumers; CropLife which encourages its members to uphold FAO principles on the distribution and use of pesticides; various universities which provide expert human and technical resources for supporting environmental monitoring and research; the Scientific and Industrial Research and Development Centre which carries out research into agricultural production, looks into issues of food security, and also houses the Cleaner Production Centre; the Drug and Toxicology Information Service which carries out research, advocacy and awareness raising on chemicals management; and the GEF-Small Grants Programme which is raising awareness on POPs in communities.

Assessment of POPs in Zimbabwe

Assessment with respect to POPs Pesticides

POPs pesticides have never been formulated in Zimbabwe, and although they were historically used for tsetse control and in agriculture, they are now all banned. The latest POP to be banned in Zimbabwe is endosulfan, which was deregistered in 2014. Stocks of the pesticide are still available in the country, though. The registration of pesticides is done by the Ministry of Agriculture, Mechanization and Irrigation Development.

Assessment with respect to DDT

Historically, DDT was used to control tsetse fly and agricultural pests before it was banned. Now, Zimbabwe allows only the Ministry of Health and Child Care to carry out Indoor Residual Spraying (IRS) with DDT for malaria vector control. The Ministry of Health and Child Care requires about 140 tonnes of the pesticide per annum, although the exact volumes imported vary from year to year depending on availability of funds. The DDT is strictly sprayed indoors in malaria-endemic areas. This is done in about 22 districts out of a total of 59 districts in Zimbabwe. The protocol for the use of DDT is tightly controlled to protect human health, animals, plants as well as the general environment.

Quantification of obsolete pesticides

In terms of determining quantities of POPs pesticides available in Zimbabwe, an obsolete pesticides inventory was carried out in 2016. The inventory targeted all obsolete pesticides, regardless of whether they are POPs or not. The main reason for targeting all obsolete pesticides is that in some stores, certain pesticides had missing labels, making it impossible to tell whether they were POPs or not, so it was more appropriate to just target all obsolete pesticides. Inventory data was collected from 58 sites throughout the country, and the total quantity of obsolete pesticides and associated materials (veterinary products, empty pesticide containers, pesticide-contaminated equipment and pesticide-contaminated material) was in excess of 80 tonnes. This included 226 different types of crop pesticides, 30 veterinary products and another 86 unidentified pesticides. Among the identified pesticides were three POPs, namely endosulfan (416 kg), lindane (5.4 tonnes) and dieldrin (50 kg). The POPs were found in 17 out of the 58 pesticide stores. Given the high number of unidentified pesticides, there are chances that the amount of POPs could be much higher than what was recorded. There is need to ensure the environmentally sound disposal of all these obsolete pesticides.

Assessment with respect to Polybrominated diphenyl ethers (POP-PBDEs)

These are brominated flame retardants that are commonly found in electrical and electronic equipment (EEE), vehicle interiors and other sources such as textiles, furniture, construction materials and carpets. An inventory of POP-PBDEs was conducted in 2016, and it revealed the presence of significant amounts of POP-PBDEs in EEE and the transport sector. In EEE, the amount of POP-PBDEs was found to be approximately 11.6 tonnes contained in 97,500 tonnes of cathode ray tube plastic casings from old computers and televisions, which will need future management. The inventory also revealed that management of e-waste is a huge challenge for Zimbabweans, with the majority of organisations and individuals failing to manage their electronic waste sustainably. In the transport sector, the amount of POP-PBDEs was found to be approximately 24.9 tonnes contained in 14,900 tonnes of polyurethane foams. Since vehicles manufactured before 2004 are the ones which contain the POP-PBDEs, and about 80% of vehicles on Zimbabwe's roads were manufactured before 2004, this implies that the majority of Zimbabweans are at risk of exposure to these chemicals.

Assessment with respect to Perfluorooctane Sulfonic Acid (PFOS)

This chemical is used as a surfactant, and is commonly found in fire-fighting foams, aviation hydraulic fluids, the chemical industry, the electroplating industry, the pulp and paper industry, and the synthetic carpet industry. An inventory of PFOS was conducted in 2016, and it revealed that the fire-fighting foams that are currently used in the local authorities contain PFOS, while those used in airports do not contain PFOS. The inventory also revealed that PFOS wastes are not managed in an environmentally sound manner. There is therefore a danger that PFOS from the fire-fighting foams will leach into the soil and contaminate groundwater, thus putting the general public who use this groundwater at risk of exposure.

Assessment with respect to Unintentionally-produced POPs

An inventory of U-POPs was carried out in 2016 to determine the amounts of U-POPs (dioxins and furans) released from the different sources. It was observed that the biggest sources of dioxin release are, in descending order, burning of waste, biomass power plants, household heating and cooking, fossil fuel power plants, medical waste incineration, biomass burning, and landfills and waste dumps.

Assessment with respect to PCBs

PCBs have never been produced in Zimbabwe, but PCB-contaminated transformers continue to be used in the country. Import of PCB-contaminated equipment most likely occurs, as there is no law compelling importers of electrical equipment to determine the PCB status of their equipment. A PCB inventory was carried out in 2011, in which 505 transformers were tested for PCB contamination, and 39 were found to be PCB contaminated. The ages of the contaminated transformers ranged from those manufactured in 1936, to some manufactured in 2007. Several pure PCB capacitors were also noted during the field inventory exercise, particularly at mineral processing operations. No pure PCB transformers were noted during the field visits, but they are expected to be present in the country.

The Zimbabwe Electricity Transmission and Distribution Company, ZETDC, which owns the majority of transformers in Zimbabwe, has about 39,000 transformers, while the Zimbabwe Power Company and other private companies have about 3,000 transformers, giving Zimbabwe about 42,000 transformers. The sample size of transformers that were tested for PCBs was quite small. Therefore there is need to carry out a more comprehensive and detailed PCB inventory. The inventory was, however, very useful as it showed that PCB contamination is not limited to the pre-1980 transformers, as had been expected, but even those manufactured in 2007 (more than 20 years after the manufacture of PCBs was discontinued) can be contaminated.

Current Level of Information, Awareness and Education

The level of awareness among members of the public, on POPs and general chemicals management issues in Zimbabwe, is very low. During the PCB inventory, it was observed that awareness of PCB issues even among those who work with transformer oil is very low, as some workers would desist from wearing the appropriate Personal Protective Equipment (PPE) when dealing with transformer oil because they "were so used to it". Although there are various programmes to raise awareness on general environmental issues, awareness raising on POPs issues is very low.

Overview of Technical Infrastructure for POPs Assessment

An assessment of the capacity of Zimbabwean laboratories to analyze for POPs was carried out. It was noted that generally, the Zimbabwean laboratories do have the capacity to test for POPs pesticides and pesticide residues, but in many cases, the analytical instruments are outdated and need to be upgraded. There are at least three known laboratories with the capacity to test for PCBs. There are no laboratories with the capacity to analyze air samples for dioxins.

Impacts of POPs in human health and the environment

An assessment on the above was conducted, and it was basically a desk compilation of studies that have been carried out in Zimbabwe. It was noted that most studies that were carried out were on DDT, and they were carried out a long time back. It was concluded that there is a need to conduct new studies, particularly on the impacts of new POPs such as POP-PBDEs and PFOS, and even some of the originally listed POPs such as PCBs and dioxins / furans

Socio-economic Assessment of POPs

An assessment was conducted to identify the negative socio-economic impacts arising from the current POPs usage practices, the positive socio-economic impacts expected from interventions for improved POPs management, and any negative socio-economic impacts that might arise from interventions for improved POPs management (as well as mitigation measures). Some of the negative impacts from current pesticide management practices that were identified included pesticide exposure for children, loss of agricultural land in the case of severe pesticide contamination, and sickness caused by pesticide exposure due to poor pesticide handling. The negative impacts arising from usage of industrial POPs included risk of exposure for: workers who handle PCB-contaminated transformers, fire-fighters who handle PFOS-containing fire-fighting foams, informal waste traders and e-waste recyclers who handle electronic waste, and ordinary members of the public who may be exposed to POP-PBDEs in old vehicles. There was also risk of exposure to dioxins / furans for those exposed to fumes from burning of waste, veldt fires and use of biomass for cooking. All these people that were exposed might then suffer from various Non-Communicable Diseases, which would result in an increased burden of disease for the nation, leading to a strain on the fiscus.

A number of positive socio-economic impacts that could arise from interventions for improved POPs management were identified. These included a healthier population resulting from reduced exposure to pesticides and other POPs, employment creation from initiatives for improved waste management, growth in the country's economy from proper e-waste recycling, and reduction in the amount of foreign currency leaving the country if old second hand vehicle imports are restricted. Restricting second–hand vehicle imports would likely result in resuscitation of car assembly industries in the country, leading to employment creation and economic growth for the country. All these would contribute to realization of the objectives of Zimbabwe's national economic blueprint, namely the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset).

Prioritized POPs Issues

After assessment of POPs, priority issues of concern were identified, and goals and objectives for addressing the priority issues were set. There were seven goals, which were further divided into 28 objectives. All these goals also responded to the requirements of the Stockholm Convention. Specific action plans for each of the objectives were then crafted. The goals and objectives are summarised in the following tables, together with the cost of the specific action plan for meeting the objective.

Goal 1: To reduce the intentional production and use of POPs within five years (Article 3 of SC)

Objective	Cost (US$)
POP-PBDEs – Specific Objectives	
Objective 1: To reduce releases of POP-PBDEs through ESM of EEE and WEEE within three years	5,150,000
Objective 2: To reduce releases of POP-PBDEs from the transport sector within three years	1,100,000
PFOS-Specific Objectives	
Objective 1: To reduce releases of PFOS into the environment within five years	840,000
New POPs Pesticide-Specific Objectives	
Objective 1: To eliminate the use of endosulfan by December 2018	55,000
Objective 2: To promote the use of alternatives to lindane for public health purposes within three years	15,000
Objective 3: To promote the use of safer alternatives for all POPs pesticides (new and original POPs) within three years	137,000
DDT-Specific Objectives	
Objective 1: To promote the use of alternatives to DDT within three years	840,000
Objective 2: To improve the management of DDT in Zimbabwe, focusing on management of waste from the DDT that is used for IRS, within two years	250,000
Objective 3: To notify the Stockholm Convention Secretariat of the need for a specific exemption for continued DDT usage within six months	
PCB-Specific Objective	
Objective 1: To reduce releases of PCBs through environmentally sound management of PCB-contaminated oils and equipment within five years	650,000
Total	9,037,000

Goal 2: To reduce emissions of U-POPs from major sources within five years (Article 5 of the SC)

Objective	Cost (US$)

Objective 1: To improve solid waste management in the country within three years, including the incorporation of the integrated waste management hierarchy	11,670,000
Objective 2: To improve the management of hazardous waste within five years, including the incorporation of integrated waste management hierarchy and the improvement of hazardous waste disposal sites	14,350,000
Objective 3: To reduce the hectarage burnt by veldt fires by 10% annually over three years	150,000
Objective 4: To reduce emissions of dioxins and furans from fossil fuel burning by 5% annually over three years	320,000
Objective 5: To promote BAT / BET in all industrial processes producing high levels of dioxins and furans, including biomass power plants within three years	110,000
Total	26,600,000

Goal 3: To strengthen the regulatory and policy framework for environmentally sound management of POPs within five years (Article 3)

Objective	**Cost (US$)**
Objective 1: To review and develop appropriate legislation and policies for POPs management within three years	340,000
Objective 2: To strengthen enforcement of existing legislation to reduce illegal trafficking of banned chemicals and sales of counterfeit pesticides / chemicals within two years	80,000
Objective 2: To promote the use of regulatory and non-regulatory incentives for POPs management within two years	40,000
Total	460,000

Goal 4: To strengthen institutional framework for managing POPs and other chemicals within five years

Objective	**Cost (US$)**
Objective 1: To improve coordination and implementation of chemicals management issues, including through the establishment of a chemicals task force and a chemicals management forum within five years	385,000
Objective 2: To enhance the capacity of the National Chemicals Emergency Preparedness Plan within five years	1,000,000
Total	1,385,000

Goal 5: To reduce releases of POPs from stockpiles and wastes through environmentally sound management of contaminated land and obsolete chemicals within five years (Article 6)

Objective	**Cost (US$)**
Objective 1: To manage contaminated sites in Zimbabwe in an environmentally sound manner, including cleaning up such sites within five years	5,102,000
Objective 2: To conduct environmentally sound management of obsolete chemicals (including pesticides and industrial chemicals) in Zimbabwe, including disposal	4,125,000

within five years	
Objective 3: To provide appropriate storage facilities for chemicals and chemical wastes within four years	2,319,000
Total	11,546,000

Goal 6: To raise awareness on the sound management of POPs and other chemicals and hazardous wastes within three years (Article 10)

Objective	Cost (US$)
Objective 1: To raise national awareness on POPs and their management within three years, focusing on safe use of chemicals, need for and promotion of safer alternatives	412,000
Total	412,000

Goal 7: To improve research and monitoring of POPs impacts on human health and the environment within five years (Article 11)

Objective	Cost (US$)
Objective 1: To commence monitoring of key environmental media, in targeted areas, for POPs and relevant hazardous chemicals within one year	300,000
Objective 2: To establish chemical surveillance for monitoring POPs (Human health and the environment) within six months	105,000
Objective 3: To assess the effects of POPs and other chemicals on human health and the environment within five years (should be linked with Objective 2 above)	330,000
Objective 4: To capacitate at least 25% of national laboratories to conduct relevant analysis for evidence based decision making within five years	1,210,000
Objective 5: To develop a good science – policy interface by which policy will advise the research sector on areas requiring research, and the research sector conducts research on these and informs policy within one year	12,000
Objective 6: To strengthen capacity for chemicals data management within three years	26,500
Total	1,983,500

Implementation of the NIP

The NIP will be implemented by various stakeholders, but most of the projects will be coordinated by the Ministry of Environment, Water and Climate, with guidance from the POPs National Coordinating Committee. The projects that are to be implemented as part of the NIP will require funding, which is to be sought from both local and international donors. There are, however, a number of action plans that have direct economic benefit to the country, so financiers, rather than donors, can be approached to bankroll such economically viable projects. A number of the interventions that are proposed in the action plans are already being addressed under other programmes that are currently running, and this therefore guarantees the successful implementation and sustainability of such interventions.

Although many of the projects will require funding, it has been noted that there are several quick wins that can be obtained without large amounts of donor-funding. These are the issues that simply need the human resources that are already on the ground to make input, in order for improvements in the management of POPs to be realized in a short time. It is proposed that the NCC identify such quick wins, so that relevant activities can be implemented immediately. Alternatively, a NIP Implementation Team can be set up to identify such quick wins, and start implementing relevant activities. Implementation of the NIP is expected to begin in June 2017.

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List of Acronyms

AFFF	Aqueous Film Forming Foam
AG	Attorney General
ARDA	Agricultural and Rural Development Authority
BAT	Best Available Techniques
BCSDZ	Business Council for Sustainable Development Zimbabwe
BDE	Brominated Diphenyl Ether
BEP	Best Environmental Practices
BFR	Brominated Flame Retardant
CAAZ	Civil Aviation Authority of Zimbabwe
CCZ	Consumer Council of Zimbabwe
CFCs	Chlorofluorocarbons
COMESA	Common Market for Eastern and Southern Africa
CP	Cleaner Production
CRT	Cathode Ray Tube
CSO	Central Statistical Office
CVR	Central Vehicle Registry
CZI	Confederation of Zimbabwe Industries
DaTIS	Drug and Toxicology Information Service
DDT	Dichlorodiphenyl trichloroethane
DecaBDE	Decabromodiphenyl ether
DR&SS	Department of Research and Specialist Services
EEE	Electrical and Electronic Equipment
EF	Emission Factor
EMA	Environmental Management Agency
EMAL	Environmental Management Agency Laboratory
ELV	End-of-Life Vehicle
EPR	Extended Producer Responsibility
ESM	Environmentally Sound Management
FAO	Food and Agricultural Organization of the United Nations
FFF	Fire-fighting Foam
FFRI	Fertilizer, Farm Feeds and Remedies Institute
GAL	Government Analyst Laboratory
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GHS	Globally Harmonized System of Classification and Labellling of Chemicals
GOZ	Government of Zimbabwe
HBCD	Hexabromocyclododecane
HCBD	Hexachlorobutadiene
HHP	Highly Hazardous Pesticide
IAEA	International Atomic Energy Agency
ICT	Information Communication and Technology
IES	Institute of Environmental Studies
ILO	International Labour Organization
IPM	Integrated Pest Management
IRS	Indoor Residual Spraying

IVM	Integrated Vector Management
LC_{50}	Lethal Concentration required to kill 50% of the population
LLIN	Long Lasting Insecticidal Net
M&E	Monitoring and Evaluation
MAMID	Ministry of Agriculture, Mechanization and Irrigation Development
MCAZ	Medicines Control Authority of Zimbabwe
MEA	Multilateral Environmental Agreement
MEPD	Ministry of Energy and Power Development
MEWC	Ministry of Environment, Water and Climate
MFED	Ministry of Finance and Economic Development
MHCC	Ministry of Health and Child Care
MHTESTD	Ministry of Higher and Tertiary Education, Science and Technology Development
MIC	Ministry of Industry and Commerce
MICTPCS	Ministry of Information and Communication Technology, Postal and Courier Services
MJLPA	Ministry of Justice, Legal and Parliamentary Affairs
MLGPWNH	Ministry of Local Government, Public Works and National Housing
MLRR	Ministry of Lands and Rural Resettlement
MMIBS	Ministry of Media, Information and Broadcasting Services
MMMD	Ministry of Mines and Mining Development
MPSE	Ministry of Primary and Secondary Education
MPSLSW	Ministry of Public Service, Labour and Social Welfare
MRDPPNCH	Ministry of Rural Development, Preservation and Promotion of National Culture and Heritage
MSDS	Material Safety Data Sheet
MTID	Ministry of Transport and Infrastructural Development
MYIEE	Ministry of Youth, Indigenization and Economic Empowerment
NCC	National Coordinating Committee
NGO	Non-Governmental Organisation
NIP	National Implementation Plan (for the Stockholm Convention)
NMCP	National Malaria Control Programme
NSSA	National Social Security Authority
OctaBDE	Octabromodiphenyl ether
OHSAS	Occupational Health and Safety Assessment Series
OPC	Office of the President and Cabinet
OSH	Occupational Safety and Health
OSHEMAC	Occupational, Safety, Health and Environmental Managers Course
PAH	Polycyclic Aromatic Hydrocarbon
PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated Biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PCN	Polychlorinated naphthalene
PCP	Pentachlorophenol
PCU	Project Coordination Unit
PeCBz	Pentachlorobenzene
PentaBDE	Pentabromodiphenyl ether
PFAS	Perfluorinated Alkylated Substances
PFOS	Perfluorooctane Sulfonic Acid
POP-PBDE	Polybrominated diphenyl ether listed as POPs

POPRC	POPs Review Committee
POPs	Persistent Organic Pollutants
PPCE	Personal Protective Clothing and Equipment
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PSMS	Pesticide Stock Management System
SABONET	Southern African Botanical Diversity Network
SADC	Southern African Development Community
SAICM	Strategic Approach to Integrated Chemicals Management
SAZ	Standards Association of Zimbabwe
SC	Stockholm Convention
SIRDC	Scientific and Industrial Research and Development Centre
SLB	Service Level Benchmarking
SME	Small to Medium-scale Enterprise
TEQ	Toxic Equivalent
ToRs	Terms of Reference
TRB	Tobacco Research Board
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
U-POPs	Unintentionally Produced Persistent Organic Pollutants
WEEE	Waste Electrical and Electronic Equipment
WHO	World Health Organization
ZERA	Zimbabwe Energy Regulatory Authority
ZESA	Zimbabwe Electricity Supply Authority
ZETDC	Zimbabwe Electricity Transmission and Distribution Company
Zim Asset	Zimbabwe Agenda for Sustainable Socio-Economic Transformation
ZIMRA	Zimbabwe Revenue Authority
ZIMSTAT	Zimbabwe National Statistics Agency
ZPC	Zimbabwe Power Company
ZRP	Zimbabwe Republic Police

CHAPTER 1. INTRODUCTION

Objective of the National Implementation Plan

This National Implementation Plan (NIP) has been produced as a guiding document that spells out how Zimbabwe will meet its obligations under the Stockholm Convention on Persistent Organic Pollutants. The NIP, which is a requirement under Article 7 of the Convention, identifies Zimbabwe's priority issues concerning POPs, and sets out action plans for addressing the priority issues.

The Stockholm Convention

The Stockholm Convention (SC) is a global treaty that aims to protect human health and the environment from a group of highly toxic chemicals known as Persistent Organic Pollutants (POPs). POPs are defined as having the following properties:

- Persistence: POPs persist in the environment for long periods of time. They resist physical, chemical and biological degradation. Therefore, once POPs enter the environment, they can remain there for many years.

- Bioaccumulation: POPs are lipophilic; meaning they easily dissolve in fats. They therefore accumulate in fatty tissues of living organisms to concentrations higher than that in surrounding environments.

- Subject to long range transport: POPs are chemical pollutants that can travel long distances in the environment (up to thousands of kilometres) and can cause problems in areas far from where the chemical originally entered the environment. POPs are mainly transported over long distances on air currents, in water or by migratory species.

- Toxicity to both humans and wildlife: POPs are known to have adverse effects on humans and the environment, and their effects on humans include cancer, allergies, hypersensitivity, and damage to the nervous, reproductive and immune systems.

POPs can be grouped into three classes, namely pesticides, industrial chemicals and unintentionally-produced POPs (also known as U-POPs which arise primarily as a result of combustion of chlorine or other halogen-containing materials and wastes). There is therefore a wide range of sources of POPs, and the potential for human or environmental exposure is very high.

Because of the global nature of the POPs problems, the world's governments joined forces in tackling the issue of POPs, and in May 2001, adopted the Stockholm Convention. The Convention came into force in May 2004. The Convention requires parties to eliminate the production and use of all intentionally produced POPs (listed under Annex A of the SC), restrict the use of certain chemicals (listed under Annex B), and reduce and eliminate the release of unintentionally produced POPs (listed under Annex C).

When the Stockholm Convention was adopted in 2001, 12 chemicals (referred to as the "Dirty Dozen") were listed as POPs. Since then, 14 more chemicals have been added, bringing the total number of chemicals listed in the SC to 26. The full list of the 26 POPs is shown in Table 1.

Table 1: POPs listed in the Stockholm Convention

Name of POP	Class	Annex in Convention	Use
Originally included in the SC in 2001			
Aldrin	Pesticide	A	Was applied to soil to kill termites, grasshoppers, and other insect pests
Chlordane	Pesticide	A	Was used to control termites and as a broad-spectrum insecticide on a range of agricultural crops
Dichloro-diphenyl-trichloroethane (DDT)	Pesticide	B	Was sprayed on a variety of agricultural crops, especially cotton, but is currently being used only for malaria vector control in several countries
Endrin	Pesticide	A	Was sprayed on the leaves of crops such as cotton and grains; and was also used to control rodents such as mice
Heptachlor	Pesticide	A	Was used to kill soil insects and termites; and also more widely to kill cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes
Hexachlorobenzene	Pesticide	A	Was used for treating seeds as it kills fungi that infect food crops; it was also used to control wheat bunt
	(U-POP)	C	Is also a by-product of the manufacture of certain industrial chemicals and exists as an impurity in several pesticide formulations
Mirex	Pesticide	A	Was used mainly to combat fire ants; and has been used against other types of ants and termites; and has also been used as a fire retardant in plastics, rubber, and electrical goods
Toxaphene	Pesticide	A	Was used on cotton, cereal grains, fruits, nuts, and vegetables; and also to control ticks and mites in livestock
Polychlorinated biphenyls (PCBs)	Industrial chemical	A	Used as a dielectric fluid in electrical transformers, capacitors, voltage regulators, electromagnets; and as an additive in paint, carbonless copy paper, and plastics
	U-POP	C	Are also a by-product of certain industrial processes involving chlorinated substances
Polychlorinated dibenzo-p-dioxins; – also referred to simply as dioxins (PCDD)	U-POP	C	Are produced unintentionally due to incomplete combustion, as well as during the manufacture of pesticides and other chlorinated substances They are emitted mostly from the burning of hospital waste, municipal waste, and hazardous waste, as well as from automobile emissions, peat, coal, and wood
Polychlorinated dibenzofurans also referred to simply as furans (PCDF)	U-POP	C	Are produced from processes similar to those giving rise to polychlorinated dibenzo-p-dioxins

Name of POP	Class	Annex in Convention	Use
Added to the SC in 2009			
Alpha hexachlorocyclohexane (alpha HCH)	Pesticide and by-product	A	Is a constituent of technical hexachlorocyclohexane (HCH) which is used as an organochlorine insecticide or chemical intermediate to manufacture enriched hexachlorocyclohexane (lindane)
Beta hexachlorocyclohexane (beta HCH	Pesticide and by-product	A	Is a constituent of technical HCH which is used as an organochlorine insecticide or chemical intermediate to manufacture enriched HCH (lindane)
Chordecone	Pesticide	A	Was used as an insecticide on tobacco, ornamental shrubs, bananas, citrus trees; and in ant and cockroach traps
Lindane	Pesticide	A	Is used as an insecticide on fruit and vegetable crops, for seed treatment and in forestry. It is also used as a therapeutic pesticide in humans (for treatment against scabies and head lice).
Hexabromobiphenyl	Industrial chemical	A	Is used as a fire retardant in thermoplastics for constructing machine housings such as radio and television parts; in coatings and lacquers; and in polyurethane foam for upholstery
Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octabromodiphenyl ether)	Industrial chemical	A	Is used as a flame retardant for housings of office equipment; nylon; and low-density polyethylene adhesives and coatings
Tetrabromodiphenyl ether and Pentabromodiphenyl ether (commercial pentabromodiphenyl ether)	Industrial chemical	A	Is used as a flame retardant additive in flexible polyurethane foam for furniture and upholstery and in electronic equipment
Pentachlorobenzene	Pesticide, Industrial chemical	A	Is used in polychlorinated biphenyls products, in dyestuff carriers, as a fungicide; in flame retardants; as a chemical intermediate in the production of quintozene; and as a soil fungicide
	U-POP	C	Also produced unintentionally during combustion in thermal and industrial processes; and also appears as an impurity in products such as solvents or pesticides
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride	Industrial chemical	B	is found in products such as electric and electronic parts; fire-fighting foam; photo imaging; hydraulic fluids; carpets; leather; upholstery; packaging; industrial and household cleaning products and pesticides

Name of POP	Class	Annex in Convention	Use
Added to the SC in 2011			
Endosulfan	Pesticide	A	A broad spectrum, non-systemic insecticide which is used to control a number of insects on food crops such as grains, tea, fruits, and vegetables; and on non-food crops such as tobacco and cotton. It is also used as a wood preservative.
Added to the SC in 2013			
Hexabromocyclododecane (HBCD)	Industrial chemical	A	A flame retardant additive, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. The main uses of HBCD globally are in expanded and extruded polystyrene foam insulation, while the use in textile applications and electrical and electronic appliances is smaller.
Added to the SC in 2015			
Hexachlorobutadiene (HCBD)	Industrial chemical	A	Most commonly used as a solvent for other chlorine-containing compounds
Pentachlorophenol and its salts and esters (PCP)	Pesticide	A	Has been used as herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Some applications were in agricultural seeds, leather, wood preservation, cooling tower water, rope and paper mill system. Its use has significantly declined due to the high toxicity of PCP and its slow biodegradation.
Polychlorinated naphthalenes (PCNs)	Industrial chemical and by-product	A and C	Make effective insulating coatings for electrical wires. Others have been used as wood preservatives, as rubber and plastic additives, for capacitor dielectrics and in lubricants.

1.1.1 Requirements of the Stockholm Convention

The requirements of the Stockholm Convention, which this National Implementation Plan addresses, are summarized below:

Article 3 deals with measures to reduce or eliminate releases from intentional production and use of POPs. It requires Parties to:

- prohibit and/or take the legal and administrative measures necessary to eliminate the production, use, import and export of Annex A chemicals and
- Restrict the production and use of Annex B chemicals.

Article 4 establishes a Register of specific exemptions for the purpose of identifying the Parties that have specific exemptions listed in Annex A or Annex B. It does not provide for exemptions that may be exercised by all Parties. The Register includes:

- A list of the types of specific exemptions reproduced from Annex A and Annex B;
- A list of the Parties that have a specific exemption listed under Annex A or Annex B; and
- A list of the expiry dates for each registered specific exemption.

Article 5 deals with measures to reduce or eliminate releases from unintentional production. It requires each Party to take measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination. The measures to be taken include:

- Developing and implementing an action plan designed to identify, characterize and address the release of the chemicals listed in Annex C;
- Promoting the application of available, feasible and practical measures that can expeditiously achieve a realistic and meaningful level of release reduction or source elimination;
- Promoting the development and use of substitute or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C, and
- Promoting, in accordance with its action plan, the use of best available techniques and best environmental practices for both existing sources, and new sources.

Article 6 deals with measures to reduce or eliminate releases from stockpiles and wastes. It requires Parties to:

- Develop appropriate strategies for identifying stockpiles consisting of or containing chemicals listed either in Annex A or Annex B, as well as products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C;
- Identify, to the extent practicable, stockpiles consisting of, or containing chemicals listed either in Annex A or Annex B on the basis of the strategies referred to above;
- Manage stockpiles, as appropriate, in a safe, efficient and environmentally sound manner; and
- Take appropriate measures so that such wastes, including products and articles upon becoming wastes, are handled, collected, transported and stored in an environmentally sound manner, and also disposed of in the most appropriate manner.

Article 7 requires each party to produce a National Implementation Plan (NIP), which details how the party will implement the provisions of the Convention. The requirements of the National Implementation Plan are described further under Section 1.2.2 in this document.

Article 8 deals with the listing of the chemicals under the different annexes. It makes provision for each party to submit proposals for listing a chemical in a particular annex.

Article 9 deals with information exchange and requires each party to facilitate or undertake the exchange of information relevant to:

- The reduction or elimination of the production, use and release of persistent organic pollutants; and
- Alternatives to persistent organic pollutants, including information relating to their risks as well as to their economic and social costs.

Article 10 on public awareness, information and education, requires parties to promote and facilitate awareness among policy and decision makers with regard to POPs. Parties should ensure that all available information on POPs is made available to the public and the information is kept up to date. In pursuance of this article, parties should ensure that appropriate education programmes are put in place for groups such as women, children and the least educated, as well as for workers, scientists, educators and technical and managerial personnel.

Article 11 on research, development and monitoring, requires Parties to undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants and, where relevant, to their alternatives and to candidate persistent organic pollutants, including on their:

- Sources and releases into the environment;
- Presence, levels and trends in humans and the environment;
- Environmental transport, fate and transformation;
- Effects on human health and the environment;
- Socio-economic and cultural impacts;
- Release reduction and/or elimination;

The results of such research, development and monitoring activities should be made available to the public.

Other articles in the Convention deal with technical assistance issues, financial resources and mechanisms, reporting, effectiveness evaluation, non-compliance and settlement of disputes, among other issues.

1.1.2 Requirements of the National Implementation Plan (NIP)

The Stockholm Convention, in Article 7, requires each party to produce, within two years of its entry into force and / or amendments for the country, a National Implementation Plan (NIP). The NIP is expected to be reviewed and updated on a periodic basis. The requirements of Article 7 are given in Box 1.

Box 1: Article 7 of the Stockholm Convention

ARTICLE 7

Implementation Plans

1. Each party shall:
a. Develop and endeavour to implement a plan for the implementation of its obligations under this Convention;
b. Transmit its implementation plan to the Conference of Parties within two years of the date on which this Convention enters into force for it; and
c. Review and update, as appropriate, its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties.
2. The Parties shall, where appropriate, cooperate directly or through global, regional and sub-regional organizations, and consult their national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.
3. The Parties shall endeavour to utilize and, where necessary, establish the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate.

Development of a NIP by a country demonstrates its willingness to implement its obligations under the Convention; hence, Zimbabwe has shown its commitment to meeting its obligations. The NIP will allow Zimbabwe to fulfil three fundamental objectives, namely:

i) National implementation of the Stockholm Convention;
ii) Compliance with reporting and related requirements of the Convention; and
iii) Strengthening its capacity to manage POPs and similarly hazardous chemicals.

1.1.3 The NIP Update Process in Zimbabwe

Zimbabwe developed its initial NIP in 2013. The NIP has been updated in a process that has been coordinated by the Ministry of Environment, Water and Climate, which is the national focal point for the Stockholm Convention. The process involved five key stages, which included setting up coordinating mechanisms; establishing POPs inventories and conducting baseline assessments; identifying priorities and reviewing objectives and action plans; formulating the NIP; and endorsing the NIP.

Setting up Coordinating Mechanisms

The Ministry of Environment, Water and Climate, as the executing agency, re-established the POPs Project Coordination Unit (PCU) in June 2015 consisting of a Project Manager and Project Assistant, which was responsible for project execution. This was the same team that had successfully coordinated the development of the first NIP. MEWC also reinstated the original National Coordinating Committee (NCC), which had overseen the development of the initial NIP. The NCC comprised relevant Government Departments and other key POPs stakeholders. The purpose of the 26-member NCC was to oversee the project and provide functional guidance for the project implementation. The NCC was composed of members from the following organizations:

- Ministry of Environment, Water and Climate;
- Ministry of Health and Child Care;
- Ministry of Agriculture, Mechanization and Irrigation Development;
- Ministry of Information, Media and Broadcasting Services;
- Ministry of Justice, Legal and Parliamentary Legal Affairs;
- Ministry of Local Government, Public Works and National Housing;
- Ministry of Higher and Tertiary Education, Science and Technology Development;
- Ministry of Industry and Commerce;
- Environmental Management Agency;
- Zimbabwe Electricity Supply Authority;
- City of Harare;
- Zimbabwe Revenue Authority;
- Standards Association of Zimbabwe;
- Zimbabwe National Statistics Agency;
- Scientific and Industrial Research and Development Centre;
- National Social Security Authority;
- Business Council for Sustainable Development Zimbabwe;
- University of Zimbabwe Chemistry Department;
- Environment Africa (an NGO); and

- Friends of the Environment (an NGO).

The detailed list, including the names of the NCC members, is attached to this document as Annex 1.

Establishing POPs Inventories and Baseline Assessments

The inventories were conducted by Inventory Task Teams. Five Inventory Task Teams were set up for the following classes of POPs:

- Obsolete Pesticides;
- Listed polybrominated diphenyl ethers (POP-PBDEs);
- Perfluorooctane sulfonic acid (PFOS) and related compounds;
- Unintentionally-produced POPs (U-POPs); and
- PCBs (this inventory team was established and trained in 2011, under the project to develop Zimbabwe's initial NIP).

The Obsolete Pesticides inventory team was trained by FAO in November 2015 on how to conduct the inventory, and the inventory fieldwork was conducted between May and August 2016. The other three teams (POP-PBDEs, PFOS and U-POPs) were trained in inventory methodologies by Dr. Roland Weber (an international POPs expert) in December 2015, and inventories were conducted between February and October 2016. The PCB inventory team that was set up in 2011, conducted PCB inventories in November and December 2011, and these inventories were not updated during the NIP Update project.

The baseline assessments included:

- An Assessment of the Infrastructure for the Management of Chemicals, Including POPs;
- An Assessment of the Impacts of POPs on Human Health and the Environment; and
- A Socio-Economic Assessment of POPs in Zimbabwe.

The 'Assessment of Infrastructure for the Management of Chemicals, Including POPs', was conducted by Task Teams set up from the National Coordinating Committee. The teams assessed the infrastructure for the management of chemicals, a process that resulted in the production of "*The National Profile for the Management of Chemicals, Including POPs, for Zimbabwe*". The 'Assessment of the Impacts of POPs on Human Health and the Environment' was compiled by the POPs Project Coordination Unit, while the 'Socio-Economic Assessment of POPs in Zimbabwe' was conducted by a local expert.

Identifying priorities and reviewing objectives and action plans

The POPs inventories and baseline assessments identified POPs issues of concern in Zimbabwe. The POPs issues of concern were prioritized at a workshop in December 2016, during which the objectives and action plans from the original NIP were reviewed and reformulated. The full list of participants who were involved in the inventories, baseline assessments, and reformulation of objectives and action plans, is attached to this document as Annex 2.

Formulating the NIP and action plans

The actions plans were edited, and the draft NIP was compiled between January and March 2017. This was carried out by the POPs Project Coordination Unit.

Endorsing the NIP
The NIP was endorsed at a national stakeholder workshop on 30 March 2017.

1.1.4 Progress in the Implementation of the Stockholm Convention in Zimbabwe

Zimbabwe signed the Stockholm Convention in May 2001, and ratified it in March 2012. The country has undertaken a number of activities to implement the Stockholm Convention provisions, and these include:

POPs Inventories (for implementing Articles 5 and 6)
In 2011, Zimbabwe conducted inventories of obsolete pesticides and PCBs, as well as of U-POPs in 2012. Under the NIP update process, inventories of POP-PBDEs, PFOS and updated inventories of U-POPs and obsolete pesticides were developed in 2016, and the inventory reports are available.

Reducing releases from unintentional production (implementing Article 5)
The Government is conducting programmes aimed at improving the management of waste, and also reducing veldt fires in the country. In terms of improving waste management, Zimbabwe produced a National Integrated Waste Management Plan in 2016, whose implementation is being spearheaded by the Environmental Management Agency. One of the main components being implemented under the Plan is recycling, which has led to the establishment of several recycling companies and community-based organizations involved in recycling. This is expected to see a marked improvement in waste management, which will result in the reduction of waste that is burned. In terms of reducing veldt fires in the country, the Government produced a National Fire Strategy and Implementation Plan in 2006, from which annual Fire Action Plans are produced and implemented. These Government initiatives have been developed to address some of Zimbabwe's major environmental challenges, and will simultaneously lead to a reduction in the production of unintentionally produced POPs.

Environmentally sound management of PCBs (for implementing Article 6)
Zimbabwe is participating in a regional PCB disposal project, which commenced in October 2016. The project aims to dispose of 3,000 tonnes of PCB-contaminated oils from the Southern African region by October 2021. The disposal of the 3,000 tonnes will not necessarily get rid of all the PCBs in the region, but will lead to a significant reduction in the quantity of PCBs.

Implementation Plans (for implementing Article 7)
Zimbabwe produced its first NIP in 2013, and has now produced this updated version of the NIP.

Public Information, awareness and education (for implementing Article 10)
Zimbabwe, through the Ministry of Environment, Water and Climate conducts public awareness on POPs through various platforms such as workshops, public exhibitions and electronic media. The awareness campaigns have been fairly successful, judging from the increased level of interest and concern among the target audiences. However, more needs to be done in terms of awareness raising, in order for the campaigns to have a bigger impact.

1.1.5 Scope of the NIP

The scope of the updated NIP covers the original POPs that formed the "dirty dozen". It also covers the new industrial POPs, (POP-PBDEs, HBB, HBCD, PFOS), the new POPs pesticides (lindane, alpha and beta HCH, endosulfan), and the new U-POPs (PeCBz).

The inventories and baseline assessments used data for 2015 in the majority of cases. Where data for 2015 was unavailable, data for 2014 was used instead, and in a few cases, data for 2013 was used.

The action plans that are presented in this NIP were developed on the assumption that the NIP would be implemented from June 2017 over a period of five years maximum. A number of the action plans run for three years or less.

1.1.6 Structure of the NIP

The NIP document has three Chapters, namely:

- Chapter 1: Introduction, which gives background information on the Stockholm Convention, the purpose of the NIP, and the methodology that was followed for the NIP update process in Zimbabwe;
- Chapter 2: Country Baseline Information, which gives an overview of the country profile in terms of physical and demographic context, political and geographic structure and the economy. It also presents the results of the assessment of POPs, in terms of the inventory findings, the infrastructure assessment, the assessment of POPs impacts on human health, and the socio-economic assessment;
- Chapter 3: Strategies and Elements of Action Plans of the NIP, gives an overview of the priority POPs issues identified for Zimbabwe, and describes the action plans that were developed for addressing the priority issues.

CHAPTER 2. COUNTRY BASELINE INFORMATION

2.1 The Zimbabwe Profile

2.1.1 Geography

Zimbabwe is a land locked country located in the southern part of Africa. The country is situated between latitudes 15^0 30'' and 22^0 30'' south of the equator and between longitudes 25^0 and 33^0 10'' east of the Greenwich Meridian. Mozambique borders it to the east, South Africa to the south, Botswana to the west and Zambia to the north and north-west. Zimbabwe has a total land area of approximately 390,757 square kilometres and is divided into ten administrative provinces as shown in Figure 1.

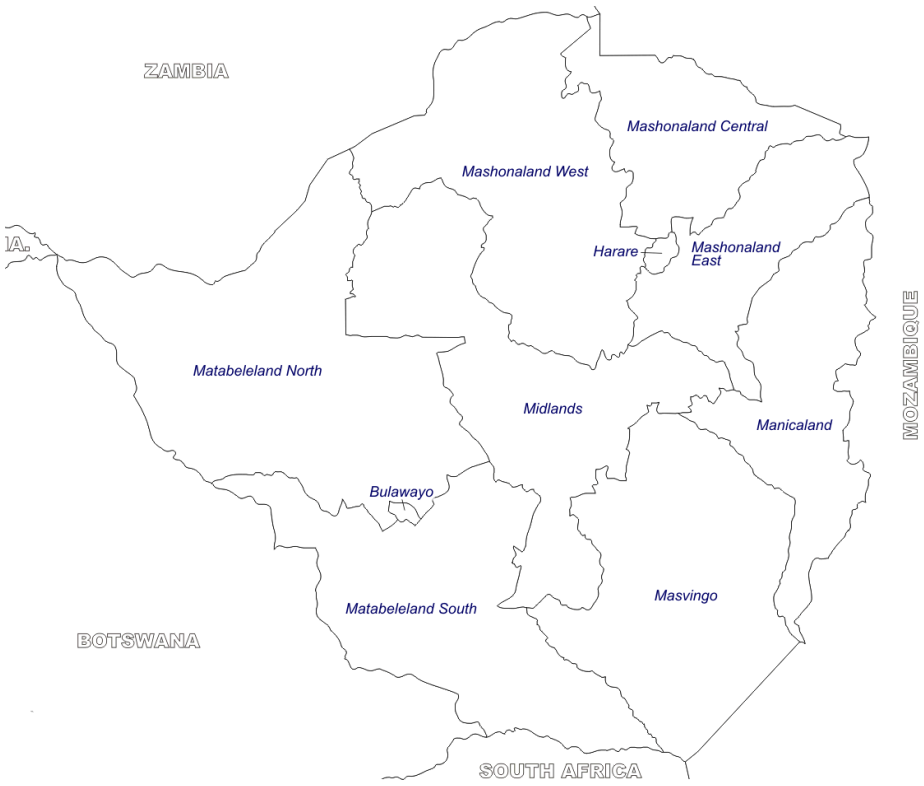

Figure 1: Administrative Provinces of Zimbabwe
Source: ZIMSTAT (2014), Compendium of Statistics

Zimbabwe's protected area network includes the gazetted forests, national parks, wildlife estates, and conservancies. These account for more than 5 million hectares of land, while the potentially arable land accounts for 8.6 million hectares of land. The country has twelve national parks and six transfrontier conservation areas (TFCAs). The TFCAs include Greater Limpopo, Kavango-Zambezi, Greater Mapungubwe, Chimanimani, Lower Zambezi-Mana Pools, and ZIMOZA. The flora in the country is dry miombo woodland, with mopane woodland and other woodland types dominating, while serpentine grasslands are found in the Great Dyke. Montane forest interspersed amongst high-altitude grasslands and heath is found in the Eastern Highlands (SABONET, 2002).

2.1.2 Political and Decision Making Structure

Zimbabwe is a unitary, democratic and sovereign state with an elected executive President who serves as both head of State and Government. The 2013 Constitution defines the legal system, and the Government has three tiers, which are the national Government; provincial and metropolitan councils; and local authorities. The parliament consists of the Upper House (Senate) and Lower House (National Assembly) which has a five-year term. The Senate consists of eighty senators and the National Assembly consists of two hundred and ten elected members. The National Assembly elects a presiding member regarded as the Speaker of Parliament.

The Constitution is the fundamental law that determines Zimbabwe's governmental structure. The Constitution provides for three arms of the State, namely the Executive, the Judiciary, and the Legislature. The Ministers are appointed by the President. Ministers are accountable to the President and are selected from members of Parliament. The President is elected for a five-year term by registered voters. The Constitution provides for two vice-presidents at a time, who are appointed by the President.

Judicial authority is vested in the Constitutional Court, Supreme Court, High Court, and subsidiary courts established by an act of Parliament, namely, magistrate courts. There are also other smaller courts, namely the local courts that are headed by chiefs and/or headmen, and the small claims courts that specifically deal with small monetary claims. The President appoints the Chief Justice, who is the head of the judiciary. The President also appoints the Constitutional, Supreme and High Court judges after consultation with the Judicial Service Commission.

2.1.3 Demographic Context

2.1.3.1 Population

In terms of demographic analysis, Zimbabwe conducts a national census every 10 years, with the last national census having been conducted in 2012. In between the censuses, Inter-Censal Demographic Surveys, as well as Demographic and Health Surveys are carried out. In this NIP, reference will be made to the 2012 census statistics.

The 2012 Population Census showed the population of Zimbabwe to be 12.97 million (ZIMSTAT, 2012). This was composed of 6.23 million males and 6.74 million females, giving a male: female ration of 48:52. The population constituted about 3.1 million households, averaging 4.2 persons per household.

The population density is 33 persons per square kilometre. The current average annual population growth rate is 1.1 %, implying that the population will double in about 70 years. Table 2 shows the distribution of the population by sex for the 2012 census.

Table 2: Distribution of Population by Sex

Province	Population			
	Males	Females	Total	Percent
Bulawayo	304,446	351,229	655,675	5.1
Manicaland	831,762	923,238	1,755,000	13.5
Mashonaland Central	559,702	580,238	1,139,940	8.8
Mashonaland East	648,207	688,852	1,337,059	10.3
Mashonaland West	721,218	728,720	1,449,938	11.2
Matabeleland North	359,173	384,698	743,871	5.7
Matabeleland South	328,009	357,037	685,046	5.3
Midlands	779,233	843,243	1,622,476	12.5
Masvingo	691,350	795,254	1,486,604	11.5
Harare	1,011,831	1,086,368	2,098,199	16.2
TOTAL	**6,234,931**	**6,738,877**	**12,973,808**	**100**

(*Source: ZIMSTAT, 2012)*

In terms of population distribution by age, it was noted that 41 percent of the total population falls in the economically active group (15-64 years), 4 percent is for the aged population (65+years), and the remaining 55 percent is below 15 years of age. This gives a broad-based population pyramid, as shown in Figure 2.

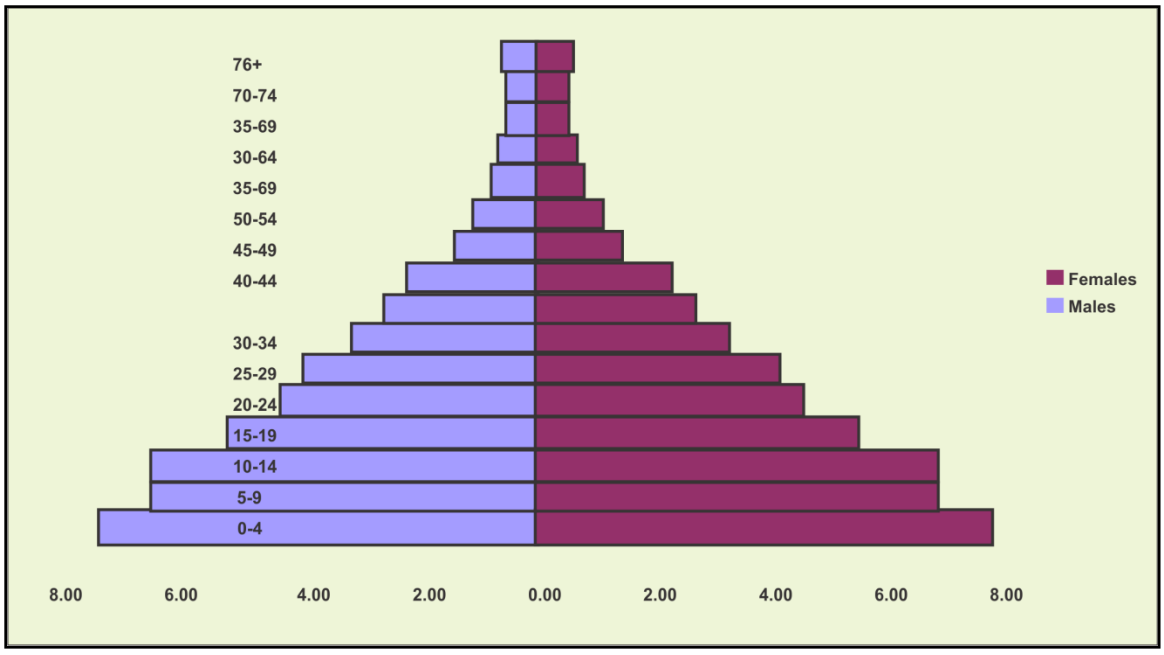

Figure 2 Population Pyramid (percent) as at 2012
(Source: ZIMSTAT (2012), National Report)

The median age is currently at 20.2 years, with the average for males currently at 19.9 years and for females at 20.4 years. Zimbabwe's birth rate is 31.9 live births per 1000 and average life expectancy is 38 years. Persons of African ethnic origin make up almost the entire population

while those of non-African ethnic origin account for approximately 1 percent. The percentage of the population living in urban areas is 33 %, while the remaining 67% lives in rural areas. Urban area refers to a compact settlement that has inhabitants of 2500 or more. 77% of the households in the country use wood as a source of energy for cooking and lighting, while about 32% use either paraffin or electricity and less than 1% use gas, coal and other forms of energy.

2.1.3.2 Languages

According to the Constitution of Zimbabwe (2013) there are 16 official languages. English, Shona and Ndebele are the languages that are most commonly used in communication, whereas the other languages are predominant for use in education and radio broadcast. The other 13 languages are Kalanga, Chewa, Venda, Koisan, Ndau, Tswana, Xhosa, Nambya, Sign language, Sotho, Chibarwe, Shangani, and Tonga.

2.1.3.3 Literacy and Employment

The country has an overall literacy rate of 97%, with 98% of males and 97% of females being literate. The average time spent in school for primary to tertiary education for Zimbabwe currently stands at 11 years as at 2012. In the employment sector (both formal and informal), the current population of working age stands at 6,083,767 whilst the unemployment rate is at 11%.

2.1.4 The Economy

2.1.4.1 Industrial, Agricultural, and other Key Economic Sectors

The major economic sectors are agriculture, forestry and fishing; industrial and manufacturing; as well as mining and mineral extraction. The agriculture, forestry and fishing sector makes the highest contribution to GDP, as shown in Table 3.

Table 3: Overview of National Economic Sectors 2011

Economic Sectors	Number of Employees	Major Products in Each Sector	Contribution to GDP (%)	Output Value (USD Million)	Growth Rate (%)
Manufacturing/ Industry Sector	271,551	Foodstuffs, beverages and tobacco, textiles, chemicals and petroleum products, metals, non-metallic minerals	10.2	1,450	-0.5
Mining and Extraction Sector	108,621	Gold, Diamond, Coal	8.1	1,157	-2.5
Agriculture, Forestry and Fishing Sector	3,573,615	Maize, Tobacco, Fish	12.0	1,705	25.0

(Source: ZIMSTAT (2014) National Accounts Report for 2012 – 2013)

2.1.4.2 Agriculture

Zimbabwe is divided into five agro-ecological regions, known as Natural Regions. The classifications into different regions are based on rainfall regime, soil type and vegetation, among other factors (Vincent and Thomas, 1960) as shown in Table 4. Natural Regions 1-3 are suitable for intensive crop and livestock production, while the remaining two regions are suitable for intensive ranching and minimal crop production.

Table 4: Description of Agro-ecological Regions of Zimbabwe

Characteristics	**Region 1: Specialized And Diversified Farming**	**Region 2: Intensive Farming**	**Region 3: Semi-Intensive Farming**	**Region 4: Semi-Extensive Farming**	**Region 5: Extensive Farming**
Rain	More than 1,000 mm per annum in areas lying below 1,700 m altitude and more than 900 mm per annum at greater altitudes	750 – 1,000 mm per annum. In parts of the region, crop yields in certain years are affected by relatively short rainy seasons or dry spells during the season.	650 – 800 mm per annum. Periodic seasonal drought. Severe dry spells even during the rainy season	450- 650 mm per annum. Periodic seasonal drought. Severe dry spells even during the rainy season	Too low and erratic for production of even drought resistant fodder and grain crops
Production	Forestry and production of fruit and intensive livestock. In frost free areas tea, coffee, macadamia nuts and other plantation crops	Crops and intensive livestock production	Livestock production together with fodder crops and cash crops. Marginal production of maize, tobacco and cotton.	Livestock production, drought-resistant crops.	Extensive cattle ranching or game ranching
Area	7,000 km² (less than 2 percent of the total area of Zimbabwe.)	58,600 km² (15 percent of the total land area of Zimbabwe.)	72,900 km² (19 percent of the total land area of Zimbabwe.)	147,800 km² (38 percent of the total land area of Zimbabwe.)	104,400 km² (27 percent of the total land area of Zimbabwe.)

(Source: ZIMSTAT (2015), Compendium of Statistics)

Region 2 is the major farming region, and has the greatest hectarage of crops, with the largest proportion of the land being under maize, mhunga (bulrush millet) and groundnuts. Table 5 shows the distribution of crops in the farming regions in 2013.

Table 5: Breakdown of Agricultural Production by Region for 2013

Region	Crop Type	Total Output of Crop(t)	Area Planted(ha)	Size of Natural Region (km^2)
I	Yams	114	77	7,000
	Tobacco	1,010	315	
	Productive Tea	3,933	220	
	Productive Sugar Cane	34	3,378	
	Maize	17,955	17,448	
II	Maize	1,884,504	2,379,428	58,600
	Wheat	52	45	
	Mhunga	59,471	351,043	
	Rapoko	13,266	40,643	
	Burley	1,162	1,117	
	Groundnuts	183,794	315,872	
	Silage	3,967,084	2,137	
III	Silage	2,757,532	103	72,900
	Irrigated potatoes	50	7	
	Maize	147,245	227,084	
	Peas	3	217	
IV	Grass Seed	1	321	147,800
	Oats	6	87	
	Sugar Cane		9,455	
V	Sugar Cane		9,412	104,400
	Seed Potatoes	21	12	
	Paprika	2	8	
	Sorghum	33,824	121,295	
Total		**9,071,063**	**3,479,724**	**390,700**

(Source: ZIMSTAT (2015), Compendium of Statistics)

2.1.4.3 Mining Sector

Zimbabwe is rich in minerals, and produces a variety of mineral products. Table 6 shows the value of minerals that were produced in 2013. As can be seen from the table, the amount of chrome that was produced in 2013 was very high. Platinum, nickel and copper were also produced in high quantities. Since processing of these metals requires the use of chemicals, the contribution made by the mining sector to chemical contamination of the environment is expected to be quite high.

Table 6: Breakdown of Mineral Production by Region for 2013

Mineral	Region where produced	Output Quantity (metric tonnes)	Output Value(USD$'000)
Asbestos	Masvingo	377.0	313.6
Chrome	Midlands	355,142.0	35,846.9
Coal	Matabeleland North	2 976.1	90,823.3
Cobalt	Mashonaland Central	318.9	3,485.8
Copper	Mashonaland West	8,284.6	44,225.1
Gold	All Provinces	14.0	621,966.0
Graphite	Mashonaland West	6,934.0	3,727.4
Iridium	Mashonaland West	0.5	8,232.4
Nickel	Mashonaland Central	12,961.9	158,302.0
Paladium	Mashonaland West	9,642.6	205,789.8
Platinum	Mashonaland West	13,065.5	554,006.5
Rhodium	Mashonaland West	1,146.1	32,891.4
Rhuthenium	Mashonaland West	1.0	1,527.5

(Source: ZIMSTAT (2015), Quarterly Digest of Statistics)

2.1.4.4 National Economic Development Programmes

Zimbabwe is a member of Regional Economic Groups (REGs), namely Southern African Development Community (SADC), Common Market for Eastern and Southern Africa (COMESA) and African Union (AU). In addition to the REGs guidelines, the Government formulated and adopted the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset) 2013 -2018, that guides all Government policies and programmes. Zim Asset was crafted to achieve sustainable development and social equity based on indigenization, empowerment and employment creation through the judicious exploitation of the country's human and natural resources. The blueprint has four main clusters namely:

- food security and nutrition;
- social services and poverty reduction;
- infrastructure and utilities; and,
- value addition and beneficiation.

The four main clusters are supported by two enabling clusters, which are fiscal reform measures; and public administration, governance and performance management.

2.1.5 Environmental Overview

2.1.5.1 Natural resources

The country has abundant natural resources that include minerals, wildlife, forestry and water resources. The major minerals are asbestos, chrome, cobalt, copper, gold, graphite, iridium, nickel, paladium, phosphate, platinum, rhodium, and rhuthenium.

Zimbabwe rich in wildlife and is home to the 'big five' which are the lion, leopard, elephant, buffalo and the rhino. These are found in several national parks and conservancies. Hwange National Park, which is part of the Kavango- Zambezi Transfrontier Conservation Area, is the largest park and hosts over 100 species of mammals, about 400 species of birds and nearly 100 species of trees and shrubs. The park also has a variety of fish species. Forests constitute about 53% of the total land area of Zimbabwe. The main products derived from forests are timber and non-timber forest products such as fruits, mopane worms, insects, honey, mushrooms, bush meat, bark string, thatch and broom grass, and browse for livestock.

In terms of hydrology, there are seven water catchments in the country, namely Manyame, Mazowe, Gwayi, Runde, Sanyati, Save and Mzingwane. The country has about 10,000 small, medium and large dams which are mainly used for irrigation and hydropower. The country relies on surface water resources for 90% of its requirements, while groundwater supplies the remaining 10%. There is significant commercial fishing in Zimbabwe, which occurs mainly in five lakes and dams: Lake Kariba, Lake Chivero, Lake Mutirikwi, Mazvikadei Dam and Manyame Dam. Kariba fisheries are the largest and contribute 60-70% of Zimbabwe's total fish output, with kapenta (*Limnothrissa miodon* and *Stolothrissa tanganicae*) being the main fish type. The smaller dams, rivers and ponds support small-scale (artisanal) fisheries and provide fish for subsistence purposes.

2.1.5.2 Climate and Soils

Zimbabwe experiences four seasons which are: cool season (mid-May to August), hot season (September to mid-November), the main rainy season (mid-November to mid-March) and the post rainy season (mid-March to mid-May). Zimbabwe's seasons can also be divided into just winter and summer, which correspond to the dry and wet season, respectively. The dry season, characterized by low rainfall and humidity, runs from May to October. The wet season runs from November to March. Mean annual maximum temperatures range between 22°C in the Eastern Highlands and 32°C in the Lowveld. The corresponding mean annual minimum temperatures are 10°C and 16°C, respectively.

The three types of rainfall received in Zimbabwe are Topographic / Relief, Frontal and Convectional. Convectional rainfall, which accounts for about 90% of the rains received, is mainly influenced by the Inter Tropical Convergence Zone in the northern part of the country, South Easterlies in the south and cloud bands in the west. Zimbabwe's rainfall is affected by the El Nino Southern Oscillation (ENSO) phenomenon and the Botswana Upper High Influence. Rainfall ranges from between 500 mm along the Limpopo Valley to 1,000 mm in the Eastern Highlands. Zimbabwe's soils are classified into eight major groups, namely the regosols, lithosols, vertisols, siallitic, fersialitic, paraferralitic, orthoferralitic and the sodic.

2.1.5.3 Environmental Challenges

Zimbabwe faces a number of environmental challenges. The major ones are poor waste management, veldt fires, climate change, land degradation, biodiversity loss and deforestation.

Poor waste management is one of Zimbabwe's biggest environmental challenges. Issues pertaining to poor solid waste management include failure to practise integrated waste

management leading to generation of unsustainably high volumes of waste; insufficient collection of waste leading to waste burning and proliferation of illegal waste dumps; and absence of properly engineered landfills, resulting in the disposal of waste on unlined and poorly managed dumpsites. One of the fastest growing waste streams is electronic waste, which is known to contain toxic chemicals such as the heavy metals cadmium and arsenic, as well as the non-degradable brominated flame retardants. Its indiscriminate disposal therefore poses a danger to humans and the environment. Liquid waste is also poorly managed, with untreated or partially treated effluent often being discharged into water bodies. All these practices lead to pollution of air, water and soil. The Government is working closely with stakeholders to improve the management of waste.

Veldt fires are another major environmental challenge, with large tracts of grassland and forests being destroyed by fires annually, especially during the dry, windy season. Lives are often lost in the fires, and the value of property that is lost in the fires amounts to hundreds of thousands of dollars. In 2014, 12 lives were lost in veldt fires, while 14 lives were lost in 2015. In 2015 1,510,343 hectares were destroyed in fire incidences, and property worth US$398,688 was destroyed. These veldt fires therefore have severe negative social, environmental and economic impacts. Several programmes are being implemented to curb the incidences of veldt fires.

Climate change is a serious environmental challenge for Zimbabwe, in that there are several processes which contribute to greenhouse gas emissions in the country, and Zimbabwe is also being affected by the adverse effects of global climate change. The main causes of greenhouse gas emissions in Zimbabwe include urbanization, motorization, economic activity and power generation using fossil fuels, use of biomass for energy especially for domestic heating and cooking, and open burning processes such as waste burning and veldt fires. In terms of effects of climate change, Zimbabwe has been experiencing increased floods and droughts. Several programmes are therefore in place to promote climate change mitigation and adaptation.

Biodiversity loss is another environmental problem which Zimbabwe faces. The country is rich in biodiversity, but the biodiversity is under threat from a number of causes. The biggest threats to biodiversity are habitat loss as a result of land use changes (expansion of urban centres, mining and infrastructure development, and agriculture expansion), climate change impacts and pollution of ecosystems. Invasive alien species and unsustainable exploitation of natural resources also contribute significantly to the loss of biodiversity. The unsustainable exploitation of natural resources includes excessive tree cutting for tobacco curing and firewood, as well as unsustainable harvesting of natural resources as an income source.

Another environmental challenge is land degradation, which occurs mainly as a result of poor soil conservation strategies and illegal mining activities. This has resulted in the formation of gullies and un-rehabilitated trenches that have often caused injuries to humans and livestock. Deforestation is also a common problem, and is largely caused by cutting trees for firewood, and opening up forests for agriculture, mining and urban expansion.

2.1.6 Natural Disasters

Zimbabwe often experiences natural disasters, namely floods and droughts. In 2013 alone, 11 lives were lost due to floods in Zimbabwe. Other natural disasters that often strike include lightning and hailstorms, which frequently destroy homesteads and crops.

2.1.7 Current Legislation and Regulations Addressing POPs

Currently there exists a robust legislative environment for addressing general environmental management issues. The different pieces of legislation are shown in Table 7. Although the legislation is quite thorough in addressing general environmental management issues, it falls short when it comes to specific POPs, as described later in the document.

Table 7: Summary of Legislation Addressing Environmental Management Issues, with Particular Reference to POPs

Relevant Act /Statutory Instrument	Areas covered	Government Ministry / Agency responsible for Enforcement
Environmental Management Act (Chapter 20:27)	• Provides for the management of general waste, hazardous waste, hazardous substances and air emissions • Employs Polluter-Pays-Principle	Environmental Management Agency
Statutory Instrument 12 of 2007 on Hazardous Substances, Pesticides and Toxic Substances Regulations	• Regulates and controls the use, sale, transporting, manufacturing, importing and storage of hazardous substances • Provides the list of the chemicals considered to be hazardous substances and classifies them	Environmental Management Agency
Statutory Instrument 10 of 2007 on Hazardous Waste Management	• Regulates the management of hazardous waste	Environmental Management Agency
Statutory Instrument 72 of 2009 - Air Pollution Control Regulations	• The regulations set ambient and emission standards.	Environmental Management Agency
Fertilizer, Farm Feeds and Remedies Act (Chapter 18:12) (FFRA) Pesticide Regulations Statutory Instrument 144 of 2012	• Deals with registration of pesticides in Zimbabwe	Ministry of Agriculture, Mechanization and Irrigation Development
The Factories and Works Act (Chapter 14:08)	• Provides for the registration and control of factories, the regulation of conditions of work in factories, supervision of the use of machinery, precautions against accidents to persons employed on structural work	Ministry of Public Service, Labour and Social Welfare
Statutory Instrument 68 of 1990 on Accident Prevention and Workers Scheme (under the Factories and Works Act)	• Provides for the duties of the employers with respect to creating a safe and healthy work environment for workers • Provides for the duties of manufacturers in respect of substances liable to cause risk to the safety and health of workers	Ministry of Public Service, Labour and Social Welfare - National Social Security Authority

2.1.7.1 The Environmental Management Act (Chapter 20:27)

The main piece of legislation governing environmental management in Zimbabwe is the Environmental Management Act (Chapter 20:27), which was enacted in 2002. The Act provides for the sustainable management of natural resources and protection of the environment, as well as the prevention of pollution and environmental degradation.

The Act is administered by the Environmental Management Agency, which is a parastatal under the Ministry of Environment, Water and Climate. In terms of general environmental rights and principles, the Act accords every person in Zimbabwe the right to a clean environment that is not harmful to health and the right to access environmental information. The Act also accords every person the right to protect the environment for the benefit of present and future generations and to participate in the implementation of the promulgation of reasonable legislative, policy and other measures that prevent pollution and environmental degradation.

Although the Act does not make reference to most POPs specifically, it does however provide for the management of general waste, hazardous waste, hazardous substances and air emissions. The Act sets standards for waste in Zimbabwe and also provides for the management of general waste. The Act makes use of the Polluter Pays Principle, requiring polluters to pay for cleaning up the environment.

The Act prohibits the discharge of hazardous substances, chemicals and materials or oil into the environment. In particular, Statutory Instrument (SI) 12 of 2007 on Hazardous Substances, Pesticides and Toxic Substances Regulations, regulates and controls the use, selling, transporting, manufacturing, importing and storage of hazardous substances. It provides the list of the chemicals considered to be hazardous substances and classifies them.

Under the same Environmental Management Act is the Air Pollution Control Regulations, which is Statutory Instrument 72 of 2009. The regulations set ambient and emission standards and provide for the monitoring and control of emissions from mining, stone crushing, cement production, grinding and processing of asbestos.

The Environmental Management Act, together with its associated regulations, acts as a starting point for POPs management, but its failure to address specific issues pertaining to PCBs, dioxins and furans poses a big challenge in the management of these POPs.

For instance, there is no legislation that requires new transformers coming into the country to be tested for PCBs. This will invariably make it difficult to reduce the levels of PCBs in the country. The theft of transformer oil is also quite rampant, and there is need to make this a high-level crime, carrying very stiff penalties. The issue of PCDD/PCDF (dioxins and furans) being released from burning of waste is also not being addressed sufficiently, as the burning of waste as a means of managing waste is so rampant, implying that any laws prohibiting burning of waste are not being enforced strictly enough.

2.1.7.2 Fertilizer, Farm Feeds and Remedies Act (Chapter 18:12)

This Act is the current piece of legislation dealing with registration of pesticides in Zimbabwe, through its Statutory Instrument SI 144 of 2012 on Pesticide Regulations. It is administered by the Ministry of Agriculture, Mechanization and Irrigation Development. The Pesticides Registration process is described in Section 2.3.1.3.

2.1.7.3 The Factories and Works Act (Chapter 14:08)

This provides for the registration and control of factories, the regulation of conditions of work in factories, supervision of the use of machinery, precautions against accident to persons employed on structural work and for matters incidental to the foregoing. The main instrument for this is the SI 68 of 1990 under the Factories and Works Act (Regulations for Accident Prevention and Workers Compensation Schemes).

2.1.8 Non Regulatory Mechanisms for Managing Hazardous Chemicals, Particularly POPs

Besides the legal mechanisms, there are a number of non-regulatory mechanisms that are employed in Zimbabwe in order to improve chemicals management. These are voluntary, and are usually employed by organizations who want their products to be competitive on the international market, or those organizations that have recognized the cost-cutting effect of producing goods in an environmentally sustainable manner. These mechanisms include:

- Environmentally sound technologies (formerly known as, and encompassing Cleaner Production); and
- Environmental Management Systems (ISO 14001).

<u>Environmentally Sound Technologies (formerly known as, and encompassing Cleaner Production)</u>

Some industries are opting for cleaner production technologies as a way of pollution prevention and promotion of safer, non-toxic substitutes. The cleaner production concept of increasing resource use efficiency to reduce waste and recover materials for reuse is helping to reduce the emissions of certain chemicals.

Some successes with the Cleaner Production Centre in industry have been a result of the different companies' direct initiative to adhere to the green economy by implementing Cleaner Production technologies. The main focus is on resource efficiency since raw materials costs are proving quite costly and the enforcement of the Environmental Management Act is causing industry to try to address their environmental challenges. The advantage of companies implementing Cleaner Production has been that the Environmental Management Agency acknowledges efforts put towards this initiative and gives the company time to implement the cleaner production options before it shuts down the establishment. Industry in Zimbabwe has also embarked on Cleaner Production as a result of a desire to expand into global markets where 'going green' is critical to acceptance by both suppliers and consumers.

ISO 14001 Environmental Management Systems

Other voluntary environmental management mechanisms include systems certification schemes like ISO 14001 offered by the national standards body, Standards Association of Zimbabwe (SAZ). Zimbabwe, through SAZ, adopted the international standard as a national standard.

The Environmental Management System (EMS) is a voluntary system that is taken up by industries, which compels them to abide by international best practices in terms of environmental management. The ISO 14001 Environmental Management System certification is useful especially in terms of PCBs management, since organizations seeking certification are required to document the PCB status of their electrical equipment (power transformers and capacitors).

The Standards Association of Zimbabwe offers voluntary environmental management certification schemes to companies wishing to have third party assurance that they meet the requirements set in the standard. SAZ has so far registered 24 companies to the ISO 14001 standard, with two having multi-site registration.

These non-regulatory mechanisms are very useful for protecting the environment from the harmful effects of chemicals. However, their non-regulatory nature causes their uptake to be limited.

2.1.9 International Commitments and Obligations

Zimbabwe is party to a number of chemicals management related conventions. These include the Stockholm Convention on Persistent Organic Pollutants¸ the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, and the Bamako Convention on the Ban of the Importation into Africa of Hazardous Waste. Zimbabwe has also signed the Minamata Convention on Mercury, but has not yet ratified it.

The Stockholm Convention is aimed at protecting human health and the environment from POPs. It requires parties to reduce the production and / or use of POPs, with the goal of ultimately eliminating them. The Basel Convention aims to protect human health and the environment against the adverse effects of hazardous wastes. This is to be achieved through the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous waste; the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and providing a regulatory system applying to cases where transboundary movements are permissible.

The Rotterdam Convention aims to promote shared responsibility and cooperative efforts among parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm. It also aims to contribute to the environmentally sound use of those hazardous chemicals by facilitating information exchange about their characteristics, by providing for a national decision making process on their import and export, and by disseminating these decisions to parties. The Minamata Convention aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

Zimbabwe is also a party to the Vienna Convention for the Protection of the Ozone Layer¸ the Montreal Protocol on Substances that Deplete the Ozone Layer, the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Zimbabwe has signed the Paris Climate Agreement, but has not yet ratified it.

Besides the chemicals related conventions, Zimbabwe is party to the Convention on Biological Diversity, the Convention on International Trade in Endangered Species and the United Nations Convention to Combat Desertification, among others. For most of these Conventions, an office has been established in the relevant Ministry responsible for administering issues pertaining to the Convention.

Zimbabwe has also ratified ILO Convention 170 concerning Safety in the Use of Chemicals at Work. The implementation of this Convention is the responsibility of the Ministry of Public Service, Labour and Social Welfare through its National Social Security Authority.

Local legislation such as the Environmental Management Act has incorporated some of the requirements of a number of international environmental conventions. These include the Montreal Protocol and Vienna Convention (through air pollution control and ban of CFC emitting substances), the Bamako Convention (through restrictions and bans on importing unregulated chemical substances), the Convention on Biological Diversity and the Convention on International Trade in Endangered species of Wild Flora and Fauna (through protecting wildlife and plant life).

One major challenge to the implementation of the chemicals and wastes-related Conventions (namely the Stockholm, Basel, Rotterdam and Bamako Conventions) is that in most cases, the requirements of the Conventions have not yet been enshrined in local legislation, hence enforcement of the Convention requirements at a local level is difficult.

2.1.10 Other National Policies, Plans and Strategies

Zimbabwe has several other important national policies / plans / strategies that can contribute to the successful implementation of measures for reducing and eliminating POPs. These policies / plans / strategies include economic, social and environmental ones, and have been taken into account in the development of the NIP. The major ones include:

a. The Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset);
b. The National Environmental Policy;
c. The National Integrated Waste Management Plan;
d. The National Fire Strategy and Implementation Plan;
e. Annual Fire Action Plans;
f. Zimbabwe's National Climate Change Response Strategy;
g. The National Biodiversity Strategy and Action Plan;
h. The Occupational Safety and Health Policy;
i. The National Energy Policy; and
j. The National Gender Policy.

The policies, plans and strategies are described in Table 8.

Table 8: National Policies / Plans / Strategies That Will Contribute to Improved POPs Management

Title of National Document (Policy / Plan / Strategy)	Key Highlights of Document	Strategies in Document which will Contribute to POPs Reduction
Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset)	Zim Asset is categorized into four clusters, namely: 1. Food Security and Nutrition; 2. Social Services and Poverty Eradication; 3. Infrastructure and Utilities, and 4. Value Addition and Beneficiation, as well as two sub-clusters, namely: a. Fiscal Reform Measures; and b. Public Administration, Governance and Performance Management.	Under the four clusters and two sub-clusters, a number of outcomes, outputs and strategies that have a direct bearing on promoting the sound management of POPs, are identified. These include putting in place measures for comprehensive veldt fire management, capacitating local authorities to manage waste and pollution, promotion of renewable energy such as solar power and promoting the production and use of organic fertilizers (which makes use of organic waste and will thus promote sustainable waste management). The formation and utilization of Public – Private Partnerships (PPPs), and the engagement of communities for various sectors such as waste management, is also encouraged. Zim Asset also advocates for improved linkages between higher and tertiary education sector, research institutions, industries and government. This is in line with the need to develop a good science-policy interface that was identified as an area to be addressed in order to improve chemicals management in Zimbabwe. One strategy that is included in Zim Asset, under the Value Addition and Beneficiation Cluster is the evaluation of the country's mineral resources, which can be used to explore the feasibility of urban mining (recovering precious metals from the environmentally sound recycling of e-waste). Under the sub-clusters, several mechanisms for mobilizing and efficiently utilizing resources are identified.
National Environmental Policy	The specific objectives in the policy include optimising the use of resources and energy, promoting environmentally sustainable lifestyles, minimizing pollution and waste, supporting environmental education , supporting collation and management of environmental information, and implementing provisions of MEAs.	The policy has guiding principles that are to be operationalized through applying identified strategies. The strategies are wide-ranging and include those aimed promoting renewable and environmentally sustainable energy sources; supporting environmental education (through awareness programmes and integration into national curricula); assessing costs and benefits of DDT usage; and promoting environmentally sustainable farming systems. Other strategies are focused on building capacity for chemicals emergency preparedness; supporting programmes for environmental monitoring; promoting development of appropriate national standards; reviewing legislation to improve pollution and waste management; promoting the uptake of voluntary environmental management systems; provision of incentives; promoting partnerships between the public and private sectors and improving the management of environmental information. The policy also supports implementation of MEAs, including incorporating the MEA requirements into national legislation, and ensuring the availability of adequate capacity and resources to implement the MEAs.

Title of National Document (Policy / Plan / Strategy)	Key Highlights of Document	Strategies in Document which will Contribute to POPs Reduction
National Integrated Waste Management Plan	The goals of the Plan include minimizing solid waste generation, separating waste at source, utilizing organic waste to make organic fertilizer, promoting resource recovery, expanding markets for recyclables, and investing in environmentally sound disposal systems. Other goals include educating all sectors of society to practise integrated waste management, developing a Waste Management Information System, and developing a Solid Waste Management Policy.	Several strategies that are identified in the Plan will result in reduction of POPs, and these include measures to: promote the implementation of integrated solid waste management; encourage industries and others to undertake Life Cycle Assessment; promote and encourage cleaner production; and encourage the public to prevent solid waste generation through sustainable consumption patterns. The Plan also proposes the establishment of appropriate systems in various sectors for separation of solid waste at source, including appropriate collection and processing systems; value addition to solid waste; and the exploration and promotion of solid waste as a resource for energy generation. The Plan also proposes measures for creating an enabling policy, legal and institutional framework that promotes multi-stakeholder participation in integrated solid waste management, including enforcing fines and encouraging self-regulation. The Plan proposes measures to strengthen the capacity of local authorities to provide efficient waste management service (including developing proper solid waste disposal infrastructure). It also proposes measures for educating the public on sustainable solid waste management; promoting a product information system detailing the various disposal options for consumer products; and establishing an information reporting system for solid waste management. The Plan promotes research on appropriate technology for adaptation at the various stages of the integrated solid waste management hierarchy.
National Fire Strategy and Implementation Plan (NFSIP)	The objectives of the NFSIP include putting in place a comprehensive legal and institutional framework for effective fire management; enhancing public awareness and mobilizing adequate resources for fire management.	Strategies for meeting the objectives include developing regulations under the Environmental Management Act (which has since been done), developing functional fire protection committees, conscientizing the general public and stakeholders on fire protection and building capacity in fire protection.
Fire Action Plan 2016	The Government produces and implements annual Fire Action Plans. In developing each plan, the previous year's plan is reviewed, and actions for fire management for the current year are set, taking into consideration lessons learnt from the previous year.	The 2016 Fire Action Plan listed a number of actions that were to be carried out for fire management, and these included the production of a fire risk map; the mobilization and training of fire-fighting teams; and capacity building of Environment Sub-committees in fire management. The Plan also identified various tools for conducting fire awareness campaigns (such as advertising in the print and electronic media, producing documentaries on best practices, and mainstreaming veldt fire issues into school curriculum). The Plan listed measures for reducing / preventing veldt fire incidences such as fireguard construction and hay baling projects, installing fire towers and conducting early block burning in gazetted forests, and conducting road servitude clearing. The Plan also listed several mechanisms for improving enforcement such as serving orders on responsible persons to construct fireguards, and extending the jurisdiction of traditional leaders to wider areas.

Title of National Document (Policy / Plan / Strategy)	Key Highlights of Document	Strategies in Document which will Contribute to POPs Reduction
National Climate Change Response Strategy	The Strategy has several objectives, two of which are linked to POPs reduction. These are the development of a climate resilient energy infrastructure that is not carbon intense, as well as the promotion of sustainable land-use systems that enhance agricultural production, ensure food security and maintain ecosystem integrity.	The document identifies a number of strategies, whose implementation will directly result in the reduction and improved management of POPs. These include measures to promote use of clean energy, implement policies and regulatory frameworks that restrict release of short-lived climate pollutants including banning open burning of municipal solid waste and field burning of agricultural waste; and strengthening the enforcement of the fire management strategy. Other strategies include promoting climate smart agriculture (includes integrated pest management), implementing emission standards; providing incentives for GHG reduction and waste minimization; and establishing a revolving fund to acquire modern clean technologies. There are also a number of strategies for promoting integrated waste management including education and awareness; as well as strengthening the polluter-pays-principle; introducing prohibitive fines; and reinvesting funds raised through waste fines into the sector to enhance waste management. The policy also includes strategies to build resilience against diseases that occur because of impacts of climate change, such as malaria.
National Biodiversity Strategy and Action Plan (NBSAP)	The objectives of the NBSAP include addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across Government and society; reducing direct pressures on biodiversity and promoting sustainable use; and improving the status of biodiversity by safeguarding ecosystems.	The NBSAP identifies strategies for meeting the objectives. Some of the strategies contribute to improved POPs management, and these include measures to strengthen institutional capacity for implementation of biodiversity and ecosystems conservation through implementing the national fire protection strategy as well as promoting development of renewable energy and energy-saving alternatives through establishing financing mechanisms for renewable energy projects and scaling up renewable energy. The Plan also proposes measures to prevent pollution of ecosystems through monitoring and enforcing national quality standards for water, air and solid waste; reviewing environment fines and mechanisms for enforcement; upgrading waste dumpsites and promoting recycling and reuse of waste. The Plan also describes measures for promoting increased consumer consciousness and demand for environmentally sustainable production and services; as well as conducting assessments on the impacts of chemical use on water bodies.
Occupational Health and Safety Policy	The Policy assigns responsibilities for OSH to both employers and employees. It gives workers certain basic rights, including the right to refuse to undertake unsafe work, and the right to know the OSH risks that they are likely to be exposed to, and their effects.	The policy requires employers to develop OSH promotional programmes to raise awareness of OSH issues among both management and workers; to ensure the safe handling, storage and transportation of equipment and hazardous substances, including chemicals; to ensure the proper use of OSH protection systems, including PPE and to report all reportable accidents to the relevant authorities The policy requires workers to take reasonable care of their own safety and health and that of others; as well as to follow procedures in the performance of any task at work. Adhering to the requirements of the policy will ensure reduced occupational exposure to POPs and other hazardous chemicals, and will ensure that workers handle hazardous chemicals properly and minimise releases of POPs and hazardous chemicals into the environment.

Title of National Document (Policy / Plan / Strategy)	Key Highlights of Document	Strategies in Document which will Contribute to POPs Reduction
National Energy Policy	The Policy Goal is to provide a framework for the exploitation, distribution and utilization of energy resources. Its objectives include the development of energy supply that promotes sustainable development; promotion of investment in and usage of renewable energy; as well as increasing access to modern energy in rural areas.	Strategies identified in the Policy that will lead to improved management of POPs include measures to classify the vandalism of transmission and distribution systems as economic sabotage; observe environmental regulations in all power-sector projects; and promote sustainable renewable energy technologies (RETs). The policy also proposes measures to institute innovative funding mechanisms for RETs; raise awareness about benefits and opportunities of renewable energy; strengthen the institutional framework for research and development on RETs; and develop incentives for investment in renewable energy. The policy will increase access to modern energy in rural areas through promoting investment into stand-alone solar energy systems to cater for rural communities, as well as introducing programmes to convert to the use of electricity, petroleum products and bio-fuels, especially LPG in urban areas and biogas in rural areas, as cooking and heating fuels.
National Gender Policy	The Policy Goal is to eradicate gender discrimination and inequalities in all spheres of life and development. Its objectives include promoting equality and equity in access to economic opportunities for men and women, and increasing gender responsiveness of the environment and natural resources management strategies.	A number of the strategies in the policy will contribute to addressing gender issues in the management of POPs. These include measures to transform informal livelihood income generation into viable economic activities and broaden agro-entrepreneurship in disadvantaged areas; and to promote training programmes to enhance the skills of women and girls in entrepreneurship, business leadership, self-confidence, advocacy, negotiation skills and financial literacy. The policy also proposes measures to review the current environment and natural resources management policies and strategies and ensure the incorporation of gender perspectives into the policies; as well as to conduct research in order to highlight environmental challenges and inequalities among women and men, and recommend gender responsive strategies. The policy also proposes measures to capacitate state and non-state development agencies in gender mainstreaming in environmental policies, programmes and national environmental action plans.

Identified Issues of Concern Pertaining to the Use of Regulatory and Non-Regulatory Mechanisms for Managing Chemicals

A number of issues of concern pertaining to national and international regulatory mechanisms, as well as non-regulatory mechanisms, for chemicals management have been identified. These include:

a. The lack of sufficient monitoring and measuring equipment for use by the relevant enforcement agency, namely the Environmental Management Agency;
b. The lack of sufficient resources for monitoring illegal trade in pesticides;
c. The need to review current national legislation and procedures to align with best international practice e.g. some legislative gaps include:
    - Pesticides regulations (under FFRA) focus only on trade (importation, registration, retailing), but are silent on usage, while Hazardous Substances regulations (under EMA) talk about licensing of pesticide usage only for entities larger than 500 hectares;
    - Atmospheric Pollution Control legislation does not cover POPs (dioxins and furans);
    - The hazardous waste regulations (SI 10 of 2007) do not include the new POPs (polybrominated diphenyl ethers, pentachlorophenol, pentachlorobenzene) in the list of hazardous substances;
    - The current legislation does not require new transformers coming into the country to be tested for PCBs;
    - The current legislation does not make it mandatory for PCB equipment owners to test their equipment. There is need to put in place a requirement for all owners of transformers and capacitors to report on the PCB-status of their equipment.
d. The lack of a push factor for encouraging industries to take up non-regulatory mechanisms for promoting environmentally sound management of chemicals (due to their voluntary nature) - This is especially true among small-scale and informal industries that do not compete globally for markets. The cost (to industry) of setting up interventions for chemical management and disposal of chemical wastes (in the form of production line modifications or change of operating systems) is also high and discourages the uptake of the voluntary mechanisms. The cost by far surpasses adherence to the polluter pays principle which has punitive fines in comparison, hence industries often prefer to pollute and pay. There is therefore need for the Government to introduce incentives for industries to take up and employ non-regulatory mechanisms for environmentally sound chemicals management.
e. The failure to domesticate the requirements of a number of chemicals and wastes MEAs into national legislation makes it difficult to implement such MEAs locally.

2.1.11 Roles and Responsibilities of Organizations and Stakeholders Involved in Chemicals Management

Although there are not many players involved in the management of POPs in Zimbabwe, the number of players involved in management of chemicals in general in Zimbabwe is quite high. Table 9 summarizes the different players, both governmental and non-governmental, and the roles they play in chemicals management, and where appropriate, their roles (or potential roles) in POPs management.

Table 9: Roles of Different Organisations in Hazardous Chemicals Management

Organization	**Role in management of hazardous chemicals in general and possibly POPs where applicable**
Government Ministries, Departments, Parastatals, Academia and Research Institutions	
Ministry of Environment, Water and Climate	Has overall responsibility for developing, implementing and monitoring policies for sound environmental management, and coordinating and mainstreaming ratified multilateral and regional protocols, agreements and standards into national laws
Environmental Management Agency (under the Ministry of Environment, Water and Climate)	• Oversees the management of hazardous substances, hazardous waste and general waste • Responsible for monitoring and control of air quality • Runs a laboratory which carries out inorganic, organic and microbiological analyses
Ministry of Health and Child Care (National Malaria Control Programme)	Responsible for Indoor Residual Spraying of DDT for malaria control
Ministry of Health and Child Care (Government Analyst Laboratory)	• Offers chemical and microbiological analyses of various samples – food, water, forensic, chemical, industrial • Enforces maximum limits for pesticides residues in food • Monitors limits on maximum contamination levels for chemicals in drinking water
Ministry of Agriculture, Mechanization and Irrigation Development (MAMID) - Department of Research and Specialist Services – Fertilizer, Farm Feeds and Remedies Institute	• Responsible for pesticides registration and issuance of export and import permits • Responsible for analysis of pesticides for registration purposes • Responsible for analysis of pesticide residues in agricultural produce
MAMID – Department of Livestock and Veterinary Services	• Responsible for the prevention, control and eradication of animal pests and diseases (this department uses a lot of pesticides particularly for tsetse control, and historically used DDT and endosulfan)
Zimbabwe Electricity Supply Authority (under Ministry of Energy and Power Development)	• Generates and provides electricity for the nation, and is thus responsible for the management of the majority of transformers in Zimbabwe
National Social Security Authority (under the Ministry of Public Service, Labour and Social Welfare)	• Oversees occupational safety and health issues for workers in Zimbabwe

Organization	Role in management of hazardous chemicals in general and possibly POPs where applicable
Zimbabwe Revenue Authority – ZIMRA (under Ministry of Finance and Economic Development – MFED)	• Monitors products that are imported into the country, and enforces controls on behalf of different Ministries
Zimbabwe National Statistics Agency - ZIMSTAT (under the MFED)	• Compiles statistical data for Zimbabwe, covering a wide range of thematic areas, including import and export data, employment data, chemicals usage data
Ministry of Higher and Tertiary Education, Science and Technology Development	• Responsible for adoption and adaptation of relevant modern technologies for reducing and eliminating hazardous chemicals
Research Council of Zimbabwe	• Is mandated to promote, direct, supervise and coordinate research; It advises Government on issues of research for sustainable development whilst providing a forum for interaction and discussion for the mutual benefit of Government, academia and industrialists.
National Biotechnology Authority	• Regulates the manipulation of organisms using modern biotechnology (a powerful tool which can be harnessed in environmental management to clean air, water and polluted soil)
Universities, Research Institutes And Private Laboratories	• The 13 universities in Zimbabwe offer the human resources as well as technical infrastructure that can support environmental assessment, monitoring and scientific research.
Institute of Environmental Studies	• This non-faculty unit within the University of Zimbabwe provides a platform for environmental research and education, advisory services and networking on environmental issues.
Scientific and Industrial Research and Development Centre (SIRDC)	• Provides technical and consultancy services to industry • Houses the Cleaner Production Centre that assists industrialists to lower or eliminate the production of toxic wastes by modifying production processes • Carries out research into agriculture production and food science • Looks into issues of food and nutrition security
Drug and Toxicology Information Service	• Carries out research, awareness raising and advocacy on chemicals management
Industry and NGOs	
Business Council for Sustainable Development Zimbabwe (BCSDZ)	• Aims to encourage commitment by industry to environmentally sustainable business practices
Standards Association of Zimbabwe (SAZ)	• Is the national standards body of Zimbabwe and represents the country in regional (SADC, COMESA), continental (African Regional Organisation for Standards), and international (International Organization for Standardization, International Electrotechnical Commission) standardization activities. • Facilitates the development of national standards and encourages their implementation • Has published standards on air and water quality, waste water, environmental management, hazardous waste management and vehicle exhaust emissions testing methods • Offers standards based services, namely standards requirements training, laboratory facilities (including chemicals, and food

Organization	Role in management of hazardous chemicals in general and possibly POPs where applicable
	technology), third party product and systems (including environmental and OHSAS) certification
Confederation of Zimbabwe Industries (CZI)	• Has membership composed of industrialists including manufacturers of various commodities, and aims to be the representative voice for the manufacturing industry
Consumer Council of Zimbabwe (CCZ)	• Aims to protect consumers, protect manufacturing standards and improve consumer awareness through education
CropLife	• Has membership that comprises distributors of pesticides, and encourages its members to uphold FAO principles on the distribution and use of pesticides
GEF-Small Grants Programme	• This programme funds different environmental projects, which in the past have included projects to raise awareness on POPs among communities

Identified Issues of Concern Pertaining to Institutional Arrangements for Chemicals Management

The various organizations, both governmental and non-governmental, play a wide range of roles in chemicals management. While Government is responsible for decision-making pertaining to chemicals management, NGOs and industrial organisations also play critical roles in such processes, as most decision-making processes involve the participation of stakeholders through workshops, and inclusion on steering committees. This enables these sectors to contribute their views at these stakeholder workshops, and in the steering / coordinating committee meetings. However, two main issues of concern pertaining to institutional arrangements for chemicals management have been identified, and they are as follows:

a. <u>The need for a good policy – science interface</u>

The research sector and tertiary institutions have shown a keen interest in the management of chemicals in the environment. However, it has been noted that there is a poor policy-science interface, with the research and academic sectors conducting research often based on their own interests, and sharing the results with Government on an ad-hoc basis. There is need to develop a good science-policy interface, where the policy sector advises the research sector on the critical areas where data and information (research) are required, and the research sector conducts research in these critical areas. The results of research should then be used to inform the development of sound policies for sustainable environmental / chemicals management. There is also need to develop a chemicals data management policy, which identifies the chemicals management data that needs to be collected, as well as the mechanisms for collecting the data, managing and analyzing it, and disseminating the information.

b. <u>The need for more civil society participation in chemicals management</u>

Generally, NGOs have directed most of their efforts to socio-economic issues such as poverty reduction and alleviation programmes. Only a few NGOs are actively involved in environmental issues and even fewer address issues of chemicals management. Limited awareness on, and the specialised nature of the chemicals management arena, together with the heavy reliance on scientific data and equipment, are some of the reasons for the disproportionate public interest. There is therefore need to develop and implement policies / mechanisms which ensure that the civil society plays a bigger role in raising awareness on chemicals-related issues.

2.1.12 Assessment with respect to Annex A POPs Pesticides

2.1.12.1 Production

There are a number of pesticide manufacturing companies, but they mostly formulate pesticides, and do not synthesize the pesticides. There is no formulation of POPs pesticides in Zimbabwe, and all POPs have been banned.

2.1.12.2 Use and Imports

The use of POPs pesticides has been discontinued as they have been banned in Zimbabwe. Historically, before they were banned, they were widely used in Zimbabwe for agriculture, industry, household and veterinary purposes. Examples of the historical uses include:

a. Usage of Dieldrin

Dieldrin was used for the control of tsetse flies along the Zimbabwe – Mozambican border from 1962 – 1967 (Zaranyika, 2003). During those years, there was an increase in pesticide application rate, from 50L / km^2 in 1962, to 144 L / km^2 in 1966. This was due to the increasing density of tsetse habitats, since the spraying started on the periphery of the tsetse-infested areas, and gradually advanced towards areas of firmly established tsetse flies, which were denser, and required more insecticide. Dieldrin was banned for use in the 1980s.

b. Usage of Endosulfan

Endosulfan is another popular POPs pesticide that has been applied for a wide range of uses in Zimbabwe. It has been used primarily for the control of tsetse flies, and also for the control of several agricultural pests.

In agriculture, endosulfan has been used extensively for the control of heliothis bollworm, the semi-looper caterpillar and aphids in soya bean and groundnut crops, aphids in potatoes, and the cutworm and red mite in maize (Zaranyika and Mugari, 1997). It has also been used against coffee pests. Endosulfan was also used for tsetse control in the 1970s and 1980s (Chapman, 1976; Chadenga, 1991). The last time when endosulfan was used for aerial spraying for tsetse control was in 1987 (Chamisa, pers com 2016).

Due to the wide range of uses for endosulfan, it is expected that significant amounts have been applied onto the Zimbabwean soil over the years. Available data shows that endosulfan was last imported into Zimbabwe in 2011, when 7,640 litres were imported (GOZ, 2013). Usage of endosulfan for agricultural purposes was banned in Zimbabwe in 2014, following its listing in the Stockholm Convention (Mushore, pers com 2016).

Despite the ban in 2014, endosulfan was still being used as at 2016. The obsolete pesticides inventory of 2016 identified new stocks of endosulfan at one farm (shown in Figure 3), which were to be used during the following agricultural season. The fact that the farmer was unaware of the endosulfan ban was a cause for concern.

Figure 3 New bottle of endosulfan awaiting usage in 2016
(*Source: MEWC, 2016)*

c. Usage of Lindane

Lindane (gamma hexachlorocyclohexane HCH), also referred to as Gamma benzene hexachloride (Gamma BHC) was one of the earliest POPs pesticides to be used in Zimbabwe. Over the years, it has been used in Zimbabwe for the control of agricultural pests, mosquito, tsetse fly, as well for public health. Lindane was the first pesticide to be used for Indoor Residual Spraying against the malaria mosquito in 1949 in the Mazowe Valley. Lindane was also used intermittently for tsetse control in the 1950s, e.g. in clearing tsetse from areas where the Batonga people were to be resettled after the construction of the Kariba Dam.

Lindane was also used against a wide range of agricultural, garden, and household pests, including aphids, beetles, grasshoppers, bedbugs, fleas, cockroaches and lice. The use of lindane has now been banned for agriculture in Zimbabwe, and it was last imported into the country in 2007, when four tonnes were imported (GOZ, 2013). In spite of the fact that lindane has been banned, it is still being advertised by some registered pesticide dealers. This implies that enforcement of legislation pertaining to agricultural pesticides is low, and needs to be improved.

Lindane is also used as a public health pesticide, for the control of scabies and head lice. It is prescribed as a second line treatment option for the conditions, and is sold over the counter, without the need for a prescription. Given the fact that lindane is a known persistent organic pollutant, there is need to review the legislation pertaining to use of lindane for public health purposes in Zimbabwe.

d. Usage of Chlordane

Chlordane was historically used in agriculture as a pesticide in tobacco farming. It was also used in the construction industry as a termiticide in building foundations and as an additive to plywood adhesives. It has also been used as a household pesticide against ants. Chlordane was last imported into the country in 2003, when 20,000 litres were imported (GOZ, 2013). It is now banned in Zimbabwe, but in spite of the ban, it was observed to be still available on supermarket shelves as late as 2011, being sold as a pesticide for controlling ants in the home (GOZ, 2013).

2.1.12.3 Registration of Pesticides

Registration of pesticides is carried out by the Pesticides Registrar in the Ministry of Agriculture, Mechanization and Irrigation Development (MAMID) as provided for by the Fertilizers, Farm Feeds and Remedies Act (18:12) of 1996. Only registered Zimbabwean companies are allowed to register and import pesticides.

The process of registration involves identification of the manufacturer of the pesticide, who will provide a Letter of Authorization to the Pesticides Registrar, giving the Registrar the permission to register the local distributor (local company) using the manufacturer's information. The applicant (local company) must also submit a dossier containing:

- draft Zimbabwean labels,
- material safety data sheets,
- toxicological data,
- sworn statement of product content, and
- certificate of active ingredient analysis of pesticide sample – one from the manufacturer and one from a Zimbabwean Government laboratory (either Fertilizers, Farm Feeds and Remedies Institute or the Tobacco Research Board).

Efficacy data from field trials conducted in Zimbabwe should also be submitted. The duration of efficacy field trials is one season for generics and three consecutive seasons for non-generics. Additional field efficacy data from countries with climatic conditions similar to Zimbabwe may also be provided where available. Evidence of product registration in the country of origin is also required. It should be noted that pesticides are to be sourced from the manufacturer only and not from traders.

The pesticides registration process for Zimbabwe is therefore quite rigorous and should achieve its goal of ensuring safe and efficient use of pesticides in the interest of the user, the consumer and the public. However, while registration of pesticides is mandatory and is carried out by all registered pesticides manufacturers, it has been observed that there are many informal players who are formulating and / or packaging pesticides in their backyards often using banned substances, thereby circumventing the formal registration process. These unregistered pesticides are sold on the streets, and of late, some unlabelled pesticides have been discovered on the shelves of registered retailers. This disturbing trend is putting the public at risk of exposure to highly dangerous pesticides.

Banned / Deregistered Pesticides

Certain pesticides have been banned (deregistered) by MAMID. Deregistration of a pesticide takes place when it is realized that the pesticide is too hazardous to be used without posing substantial risk to human health and the environment. Box 2 shows the list of banned / deregistered pesticides as at 2016.

Box 2: List of Banned / Deregistered Pesticides, as at 2016

Pesticides which are banned in Zimbabwe

- Aldrin,
- Chlordane,
- Dieldrin,
- Endrin,
- Heptachlor,
- Mirex,
- Toxaphene
- Endosulfan,
- Lindane / Gamma-BHC
- Pentachlorobenzene,
- Binapacryl,
- Captafol,
- Chlordineform
- Alpha hexachlorocyclohexane
- Beta hexachlorocyclohexane
- Methamidophos (Soluble liquid formulations of the substance that exceeds 600g active ingredient/L)
- Monocrotophos (Soluble liquid formulations of the substance that exceeds 600g active ingredient/L)
- Chlorobenzilate
- Dinitro-ortho-cresol (DNOC) and its salts
- Methyl-Parathion (emulsifiable concentrates (EC) at or above 19.5 % active ingredient and dusts at or above 1.5% active ingredient)
- Parathion (all formulations of this substance are included except capsule suspensions (CS))
- Dustable powder formulations containing a combination of:
  -Benomyl at or above 7 percent
  -Carbofuran at or above 10 percent
  -Thiram at or above 15 percent
- Pentachlorophenol its salts and its esters
- HCH(mixed isomers)
- Fluororacetamide
- Ethylene dichloride
- Dinoseb, its salts esters
- Mercury compounds, including inorganic mercury compounds, alkyl mercury compounds and alkyloxyalkyl and aryl mercury compounds

Restricted use Pesticides

DDT(used only for Indoor Residual Spraying to control Mosquito)
1,2-dibromoethane (EDB)

Pesticides whose import has been stopped, but where available stocks may be used off

- Fenthion
- Methamidophos – all other formulations
- Monocrotophos – all other formulations
- Paraquat
- Trichloforn

2.1.12.4 Obsolete Pesticide Stocks and Associated Materials

An inventory of obsolete pesticides was carried out from May to August 2016 to determine the quantities and locations of obsolete pesticides and associated materials (particularly empty containers) in Zimbabwe. The inventory targeted all obsolete pesticides and associated materials, regardless of whether they were POPs or not. One reason for targeting all obsolete pesticides is that in some stores, the pesticides have labels missing, making it impossible to tell whether the pesticide is a POP or not, so it was more appropriate to just target all obsolete pesticides.

The inventory was carried out by local inventory teams who had been trained by FAO. The teams visited 58 pesticide stores/ located at 55 sites throughout the country. Of the 55 sites, 53 had one store each, one site had three stores, and one site had two stores. The 55 sites from which data were collected included:

- Nine farms belonging to the parastatal Agricultural and Rural Development Authority (ARDA);
- Six pesticide company stores;
- Six agricultural colleges;
- Three vocational training centres;
- 12 commercial farms;
- Eight large agricultural estates;
- Six Government research centres;
- Three private research centres; and
- Two stores belonging to the Department of Agricultural, Technical and Extension Services (Agritex).

The obsolete pesticides that were recorded included actual pesticides, veterinary products, empty pesticide containers, pesticide-contaminated equipment, pesticide-contaminated material, pesticide-contaminated building material, and pesticide-contaminated soil. Quantities of pesticides that were recorded included 44.1 tonnes for both crop pesticides and veterinary products. A large number of empty containers was also recorded, which included 938 empty methyl bromide cylinders (ranging from 20 kg – 100 kg) and weighing in excess of 36 tonnes. The total estimate of obsolete pesticides, including empty containers, that was recorded was at least **80 tonnes**.

The inventory exercise identified 226 different types of crop pesticides, and 30 veterinary products. Another 86 unidentified pesticides were also recorded. These could not be identified because of absence of labels on the containers. Of the 226 pesticides that were identified, three were found to be Persistent Organic Pollutants (POPs), namely endosulfan, lindane and dieldrin. The quantities of POPs that were recorded were

- 416.4 kg of endosulfan;
- 5,450 kg of lindane; and
- 50 kg of dieldrin.

The total amount of POPs recorded was therefore 5,916.4 kg, which is about 13.4% of the total quantities of obsolete pesticides (excluding empty containers) recorded. These POPs were found in quite a number of the pesticide stores, with endosulfan being found at 17 stores, lindane being found at four stores, and dieldrin being found at one store.

In addition to identifying pesticide stocks and empty containers requiring disposal, the inventory also identified two sites where the soil was contaminated with pesticides. One site which was particularly bad, was at a pesticide storage facility in Mashonaland West, where fenitrothion had been stored in 200L drums in previous years. This pesticide store was first vandalised in 2003 and the incident was reported to the police by the Plant Protection Research Institute (custodians of the stocks). The store was made more secure but vandalism and pilferage continued. Eventually, the pesticide was poured onto the ground, as the vandals wanted the containers. It was unclear at the time of inventory when the pesticide was poured out onto the ground. At this site, an area of 518 m^2 of ground cover was visibly contaminated, but the depth of the contamination could not be ascertained. The smell of the pesticide was still prevalent during the inventory, and the area has been lying idle since it was contaminated. The other site was at a farm in Mashonaland Central, where 10 kg of an unknown pesticide was poured onto the ground. The site was also visibly contaminated.

On comparing the 2016 obsolete pesticides inventory with an earlier inventory that was conducted in 2011 under the project to develop Zimbabwe's initial NIP, the 2016 inventory yielded more accurate results, as it covered a wider area. In the 2011 inventory, 20 pesticide stores were visited for inventory field data collection, from which 22 tonnes of obsolete pesticides were recorded. In that inventory, the quantity of empty containers was estimated to be about 78 tonnes, giving an estimated 100 tonnes of obsolete pesticides and empty containers. However, for the 2016 inventory, a total of 58 pesticide stores were visited for inventory field data collection, from which 80 tonnes of obsolete pesticides and associated materials (including empty containers) were recorded. The 80 tonnes recorded in the 2016 inventory is therefore a more accurate figure.

Previously, no programmes for disposal of the obsolete pesticides have been undertaken in the country. Currently, however, Zimbabwe is participating in the regional project for the 'Integrated Health and Environment Observatories and Legal and Institutional Strengthening for the Sound Management of Chemicals in Africa (African ChemObs)'. The project, which is still at planning stage, aims to contribute to improved health and environment through strengthening national and regional institutions, and implementing priority chemicals and waste–related interventions. One of the expected outputs of the project is the 'Implementation of situation specific interventions and policy measures (including clean-up, import control improvements and pilot activities)'. It is envisaged that some of the obsolete pesticides will be disposed of through this project.

2.1.13 Assessment with respect to Annex B Pesticides (DDT)

Historical Usage of DDT

Historically, DDT was used for tsetse control in Zimbabwe during the period 1968 – 1990 before it was banned for this purpose. It used to be applied in three districts of Zimbabwe, namely Gokwe, Kariba and Hurungwe. During the time when it was being used for tsetse control, a total of **146,379 tonnes** of DDT was applied (Chadenga, 1991). After the ban, it was replaced by the pyrethroid Deltamethrin, which is still being used today.

DDT was also extensively used in agriculture prior to 1983, the year in which it was banned for this purpose. During that pre-1983 period before its ban, DDT was used for controlling agricultural pests such as maize stalk borer (*Busseola fusca),* cotton cutworm (*Agrotis spp)* and cotton bollworm (*Heliothis spp).* There is also evidence that DDT was used as an insecticide to control pests of stored grain (Chikuni & Nhachi, 1996).

Current Usage of DDT

Malaria in Zimbabwe

Although DDT has been banned for agricultural use and tsetse control, its use is now restricted to Indoor Residual Spraying (IRS) to control the malaria mosquito. Malaria is a major public health problem in Zimbabwe. It is the third most common cause of morbidity and mortality, coming after HIV/AIDS and tuberculosis. Annually, close to 1.5 million cases of malaria are reported, and an average of 1,000 people die from it[1].

Malaria is prevalent in the low-lying areas of Zimbabwe, with transmission being generally unstable and seasonal. Malaria transmission occurs in 45 districts (out of a total of 59 districts in the country). Figure 4 shows Zimbabwe's malaria incidence rates as at 2011.

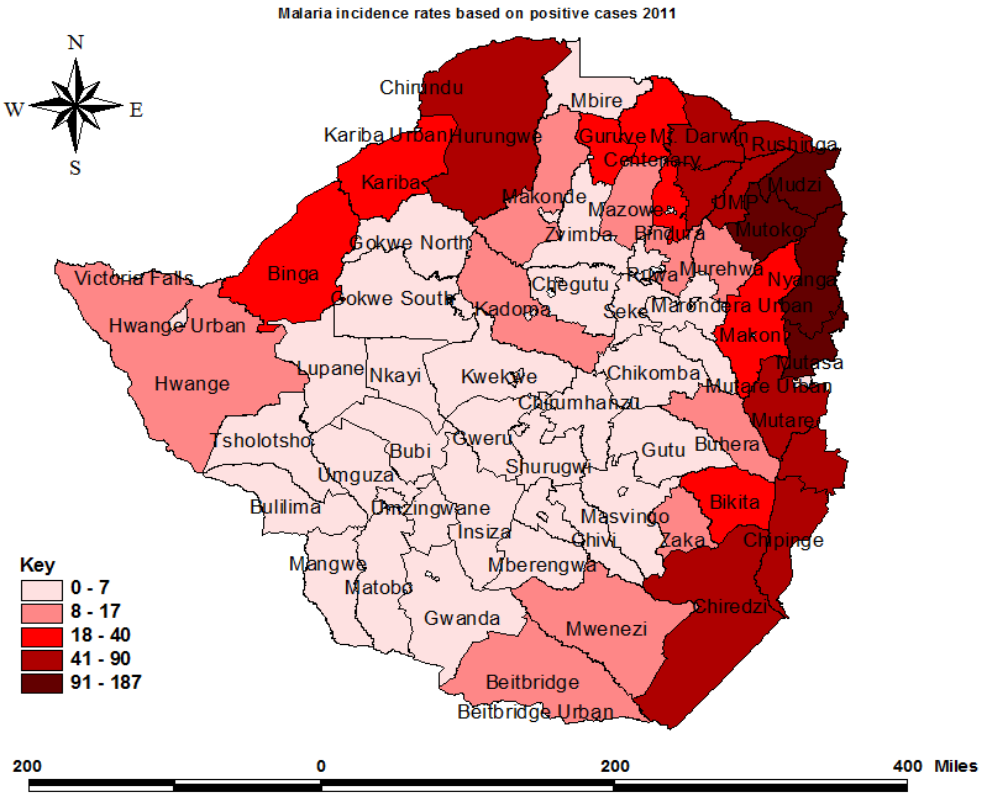

Figure 4 Zimbabwe's malaria incidence rates as at 2011

[1]http://www.psz.co.zw/Zimbabwe%20Malaria%20Treatment%20Guidelines.pdf

The primary species of the malaria parasite is *Plasmodium falciparum* which accounts for 97% of confirmed cases. The main vector mosquito is *Anopheles arabiensis.* Most malaria control programmes target the vector mosquito, through the use of Long Lasting Insecticidal Nets (LLINs) and Indoor Residual Spraying (IRS). The LLINs are treated with pyrethroids, while DDT is used for IRS.

Usage of DDT for Malaria Control

In 2006, the World Health Organization (WHO) issued a position statement promoting the use of indoor residual spraying (IRS) with DDT for malaria vector control. Zimbabwe concurred because of the great burden of malaria as well as relatively short residual effect of other groups of insecticides used to control the vector mosquitoes.

So far, DDT has been identified as one of the most effective pesticides for controlling the malaria mosquito, hence the reason for its continued use. The Ministry of Health and Child Care requires about 140 tonnes of the pesticide for its IRS programme per annum, although the exact volumes imported vary from year to year, depending on availability of funds. Table 10 shows the volumes of DDT used from 2004 to 2016.

Table 10: Quantities of DDT Used for Malaria Control between 2004 and 2016

Year	Amount of DDT used for malaria control (tonnes)
2004/5	140
2005/6	140
2006/7	76.4
2007/8	53.6
2008/9	No DDT use
2009/10	No DDT use
2010/11	225.1
2011/12	180.0
2012/13	140.0
2013/14	140.0
2014/15	122.4
2015/16	133.0
2016/17	321.9

(*Source: Annual DDT Distribution database and Annual Vector Control Reports, MHCC)*

The DDT is sprayed in malaria-endemic areas, and there are 22 districts, (out of a total of 59 districts in Zimbabwe), where DDT is sprayed. These include Bulilima, Mangwe, Beitbridge, Matobo, Gwanda, Hwange, Binga, Lupane, Tsholotsho, Mberengwa, Gokwe North, Gokwe South, Mwenezi, Chiredzi, Chipinge, Kariba, Uzumba-Maramba-Pfungwe, Mudzi, Mbire, Centenary, Rushinga and Mt Darwin.

The DDT is bought from an Indian company, Hindustan Insecticides Limited, which has a distributor in Zimbabwe, Nets for Africa. The source of funding for the DDT IRS programme has been the Government of Zimbabwe and partners in malaria control (Plan International and the Global Fund, as well as donations from neighbouring South Africa through the cross border initiative for malaria elimination agenda).

The protocol for the use of DDT by MHCC is very tightly controlled, such that chances of leakages are slim. The DDT packaging waste is sent to a local company, Hwange Colliery Company Limited, which is said to incinerate DDT waste at sufficient temperature with adequate residence time as well as mixing of combustion gases and waste or fuel feed. The incinerator is said to have facilities for complete or good combustion practices including management of the "3 Ts"- time of residence, temperature and turbulence, and sufficient oxygen (O_2) to allow complete oxidation. However, it will be necessary to determine the efficiency of these facilities.

MHCC goes to great lengths to ensure occupational safety of the spray operators. Spray operators are drawn from the community, trained on spraying techniques, and supplied with the appropriate Personal Protective Clothing and Equipment (PPCE). MHCC also reduces exposure of these workers by employing spray operators on a contract basis for one season only. Such spray operators may only be contracted again after three or four seasons. This ensures that occupational exposure for the spray operators is minimal.

2.1.14 Assessment with respect to Annex A Industrial Chemicals: POP-Polybrominated diphenyl ethers

An inventory of POP-Polybrominated diphenyl ethers (POP-PBDEs) was conducted in Zimbabwe in 2016, as part of the project for reviewing and updating Zimbabwe's National Implementation Plan for the Stockholm Convention on POPs. The purpose of the inventory was to quantify the amounts of POP-PBDEs in Zimbabwe, in order to identify the major issues of concern pertaining to the management of POP-PBDEs.

The inventory focused on quantifying the POP-PBDEs amounts from three sources, namely Electronic and Electrical Equipment / Waste Electronic and Electrical Equipment (EEE/WEEE); the transport sector; and other sources (textiles, furniture, construction materials and carpets). The inventory process was conducted at the Tier 1 (preliminary) and Tier 2 (detailed inventory) levels according to the "*Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on POPs (draft)"* (UNEP, 2015). The inventory was carried out by a multi-stakeholder inventory task team, which had been trained by an international expert.

Inventory Results

a. PBDEs from the EEE / WEEE Sector

It has been noted from literature that the major amount of commercial Octabromodiphenyl ether (c-octaBDE), which comprises the POPs hexabromodiphenyl ether and heptabromodiphenyl ether, is found in the polymer fraction of casings from CRT Computer and TV monitors produced before 2005 (UNEP, 2015). These were therefore the key fractions to be addressed by the POP-PBDEs inventories. Production of c-OctaBDE stopped in 2004; therefore, modern flat screens would be unlikely to contain POP-PBDEs.

In conducting the POP-PBDE inventory, data that was available pertaining to Zimbabwe was from an ICT survey that was carried out by the Zimbabwe National Statistics Agency,

ZIMSTAT in 2014. The survey showed the percentage of Zimbabwean households with access to a television and also access to a computer. The results did not indicate whether the televisions and computers were CRTs or flat screens. For the sake of calculations, the inventory assumed that they were CRTs, although most of the computers currently in use in Zimbabwe, and a fair amount of televisions, use flat screen monitors. However, the old CRT computers which are no longer being used are still available in many business entities, in the same manner that old, non-functional CRT televisions are still available in homes where they are just stored.

According to the 2012 census, Zimbabwe has a population of 13 million, divided into 3,090,906 households. Each household therefore has an average of four people. The ZIMSTAT ICT survey sampled 31,140 households (about 1% of all the households), and noted that 11% of households had access to a computer, while 40% had access to a television. Although it is most probable that the number of households with access to a computer will also have access to a television, it was decided to add the percentages of people having access to either a television or a computer, and so a combined value of 51% was obtained.

Since 51% of all households have access to a television / computer (and each household has approximately 4 people), then it follows that the number of people with access to a television / computer would be 51% / 4 people, which would give 13% of all individuals having access to a television / computer (or 0.13 CRTs / capita). Calculations of the POP-PBDEs indicated that there were approximately **21.5 tonnes of c-OctaBDEs containing 11.6 tonnes POP-PBDEs (HexaBDE and HeptaBDE). These PBDEs are contained in approximately 97,500 tonnes of CRT plastic casings which need future management.**

More data was collected on management of WEEE through questionnaires which were administered to private consumers (households); institutional consumers (public institutions, government, parastatals, health and educational sector); and corporate consumers (hotels, large businesses and small business enterprises). The responses showed that management of e-waste is a huge challenge for Zimbabweans, with the majority of corporates and individuals failing to manage their e-waste sustainably. Institutions will usually just store their electronic waste for long periods, while awaiting such a time that they will be able to dispose of it properly, as shown in Figure 5. There is therefore need to urgently put in place interventions for improving the management of e-waste in Zimbabwe and to develop a regulatory framework for e-waste.

Figure 5 Stored electronic waste awaiting eventual disposal

b. PBDEs from the Transport Sector

Literature has shown that commercial-Pentabromodiphenyl ether (c-PentaBDE) was mostly used in polyurethane (PUR) foam (90 – 95% of use) which was partly used for automotive and upholstery applications (UNEP, 2015). Production of c-PentaBDE occurred between 1970 and 2004. Cars, trucks and buses contain the largest volume of POP-PBDEs, hence the inventory centred on these vehicles, focusing on those that were manufactured between 1975 and 2004.

However, only a portion of the cars produced between 1975 and 2005 worldwide have been treated with c-PentaBDE. It is estimated that about 37% of the approximately 100,000 tonnes c-PentaBDE production (approximately 37,000 tonnes) has been used in the transport sector (UNEP, 2010a, 2010b). In addition, the use of c-PentaBDE depended on the national/regional legislation and production/use patterns. Approximately 90% of c-PentaBDE was used in the United States/North America (UNEP, 2010a, 2010b). In collecting inventory data pertaining to vehicles, it was therefore important to collect information on the year of manufacture, and the region of manufacture.

Data for calculating the POP-PBDEs from the transport sector was collected from the Zimbabwe National Statistics Agency (ZIMSTAT), as well as the Central Vehicle Registry (CVR). ZIMSTAT provided data on the total numbers of cars imported into the country between 1995 and 2014, while CVR provided data on the ages of vehicles imported into the country in 2014.

According to the data from ZIMSTAT, 141,401 buses, and 1,163,710 light motor vehicles / trucks were imported into Zimbabwe between 1995 and 2014. The CVR data for 2014 showed that 80% of all vehicles imported that year were manufactured between 1975 and 2004. An assumption was then made that 80% of all vehicles imported into the country between 1995 and 2014 were manufactured between 1975 and 2004.

The UNEP PBDEs Inventory guidance, states that POP-PBDEs in the transport sector are found in vehicles that were manufactured before 2005. Given that 80% of vehicles imported into Zimbabwe were manufactured between 1975 and 2004, it follows that the vehicles that contain POP-PBDEs are 80% of 141,401 (=113,121 buses), and 80% of 1,163,710 (=930,968 light motor vehicles plus trucks).

Vehicle import data (2013, 2014 and 2015) indicates that buses imported from the USA were less than 1%, while cars imported were less than 10%. This therefore implies that:

a. Number of Buses from USA = 11,311
b. Number of Buses from other regions = 101,810
c. Number of Cars from USA = 93,095
d. Number of Cars from other regions = 837,873

Calculations of PBDEs from the transport sector showed that approximately **24.9 tonnes POP-PBDE (c-PentaBDE)** are present in vehicles in Zimbabwe. These 24.9 tonnes of POP-PBDEs are included in approximately 14,900 tonnes of polyurethane foams. Since hexabromocyclododecane (HBCD), (which was listed in the SC in 2013) and DecaBDE (which has been suggested for listing in the Convention in 2017) are included in vehicles, the total amount of POPs in vehicles is considerably higher than the calculated values.

Data on end-of-life vehicles was not available, since there is no formal deregistration process in Zimbabwe for vehicles which will have reached their end of life. Therefore, there was no way to determine whether the calculated POP-PBDEs were in vehicles which were still in use, or which had joined the waste stream. However, vehicles are used in Zimbabwe for long periods and therefore most of these vehicles are still in use or stored in garages.

c. POP-PBDEs and HBCD from Other Uses (the Construction Sector, Textiles and Furniture)

The construction sector was approached to get data on the HBCD used in construction. All respondents failed to provide any meaningful information, as they indicated that they could not get information on the materials that were used for insulation in construction. Since Zimbabwe has a warm climate, the need for insulation materials was expected to be low; hence HBCD was not expected to contribute significantly to levels of POP-BFRs in the country.

A number of companies in the textile and furniture industry were also approached to collect data on the contribution of this sector to total POP-PBDEs quantities in the country. Data could not be obtained, as respondents were unaware of whether the textiles and furniture items would have been impregnated with POP-PBDEs or HBCD during the manufacture or not. The industry itself has most likely not used POP-PBDEs for the textiles and furniture produced in the country. However, furniture imported from UK in the past might contain POP-PBDEs.

d. Recommendations for Improved PBDEs Management in Zimbabwe

The PBDEs inventory identified issues of concern pertaining to PBDEs management, and came up with following recommendations:

i. It is necessary to conduct a full scale, in-depth e-waste inventory, in order to calculate the actual amounts of POP-PBDEs in e-waste in Zimbabwe. The inventory of POP-PBDEs in EEE and e-waste that was conducted could not get sufficient data for the in-depth inventory because budgetary constraints did not allow for the inventory team members to conduct face-to-face interviews with all possible respondents. The detailed inventory should also address the topic of POP-PBDEs in e-waste plastic.
ii. There is need for an appropriate regulatory frame for management of e-waste, since there is currently no regulatory framework.
iii. Programmes for improving the management of e-waste in Zimbabwe need to be formulated and implemented, since EEE inventory showed that there is a dearth of knowledge on how to manage e-waste in an environmentally sound manner. Such programmes should involve promotion of best available techniques and best environmental practices for the recycling and waste disposal of articles containing POP-PBDEs.
iv. Government should put in place and implement measures for controlling imports of second hand vehicles produced before 2005, as this will be the only way to reduce the levels of POP-PBDEs from the transport sector, and thus protect the health of the Zimbabwean populace and the environment. Currently, a very large proportion of vehicles that are imported into the country are second hand vehicles, with approximately 80% having been manufactured between 1975 and 2005. This means that the majority of vehicles in use in Zimbabwe are contaminated with POP-PBDEs, putting a significant proportion of the Zimbabwean population at risk of exposure to these chemicals, hence the need to control imports.
v. Government should put in place and implement measures for managing end-of-life vehicles. Currently, there is no policy for management of end-of-life vehicles in Zimbabwe, and the disposal or management of such vehicles is the prerogative of the owner. It is common to see vehicles which will no longer be in use, littering backyards or open spaces. Given the fact that such vehicles are very likely to contain POP-PBDEs, the chances of POP-PBDEs diffusing into the environment are high, hence these end-of-life vehicles pose a significant risk of POP-PBDE exposure for both humans and the environment.

2.1.15 Assessment with respect to Annex B Industrial Chemicals – Perfluorooctane Sulfonic Acid and Related Chemicals (PFOS)

An inventory of PFOS and related chemicals[2] was conducted in Zimbabwe in 2016, as part of the project for reviewing and updating Zimbabwe's National Implementation Plan for the Stockholm Convention on POPs. The purpose of the inventory was to quantify the amounts of PFOS and related chemicals in Zimbabwe, in order to identify the major issues of concern pertaining to management of PFOS and related chemicals.

The inventory was carried out by a multi-stakeholder inventory task team, which had been trained on how to conduct the inventory by an international expert. The inventory was conducted according to the guidance document: "*Guidance for the inventory of perfluorooctane sulfonic*

[2]In this report normally only PFOS is mentioned, which however stands for "PFOS and related substances".

acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants", developed by UNEP (UNEP, 2015).

The inventory team agreed that the possible, significant sources of PFOS and related chemicals in Zimbabwe were the fire-fighting foams, aviation hydraulic fluids, the chemical industry, the electroplating industry, the pulp and paper industry, and the synthetic carpet industry and stock and potential use of sulfuramide as pesticide.

Questionnaires for collecting data were prepared and sent electronically to local authorities, airports, mines, chemical companies, agrochemical companies, paint manufacturers, pulp and paper companies, and electroplating companies. In some cases, team members visited the respective companies to conduct face-to-face interviews. In other cases, data was collected through telephonic interviews (as in the case of the Pesticides Registrar).

Inventory Results

a. Fire-fighting Foams

Data on fire-fighting foams (FFF) was obtained from the local authorities' fire departments, the mines and from the largest airport in Zimbabwe, Harare International Airport. Since airport data was only available for Harare Airport, this data was used as baseline data, and the data for the rest of the airports was extrapolated from this data. The ratio of the volume of traffic at the different airports was used as a measure to extrapolate. Another assumption that was made was that one litre of PFOS is equivalent to one kilogram.

i. Quantities of Fire-Fighting foams held in stock, and used over the years

Four local authorities (Harare, Bulawayo, Mutare and Kariba) indicated that they use fire-fighting foams, and at least three different fire-fighting foams types were identified, namely FC0401, FC600 and FP70. Only two local authorities and Harare Airport gave the identification of FFFs. The other respondents only listed them as AFFF.

The foams which were in stock at the local authorities, were all imported between 1978 and 1989, while that at Harare airport were imported in 2007. Since the major producers of fire-fighting foams were adding PFOS to FFF up until 2003, it was assumed that FFF at the local authorities contained PFOS. For the FFF at the airports, it was assumed that this did not contain PFOS, considering that it was imported in 2007, and the MSDS from the supplier (Chemguard) also indicated that it did not contain PFOS. The responses from the mines did not show the date of import of the FFF, hence it was assumed that the FFF contained PFOS. The frequency of using fire-fighting foams in actual fire events varied from year to year in each organisation, as did the frequency of using the foams for training. Table 11 shows the total quantities held in stock by the local authorities and the mines, as well as the total quantities used for actual fire events and for training purposes.

Table 11: Quantities of Fire-fighting foams held in stock, and used over the years

Fire-fighting Foam Held in Stock		**Fire-fighting Foam Used Over the Last 20 Years**		**Fire-fighting Foam Used Annually for Training**	
Actual Quantity (tonnes)	PFOS content (kg)	Actual Quantity (tonnes)	PFOS content (kg)	Actual Quantity (tonnes)	PFOS content (kg)
26,007	258.4	1,197	11.6	56	0.56

Table 11 shows moderate usage of PFOS. Some of the respondents did not give responses to some of the questions, possibly because they did not use any PFOS for the purposes asked, or perhaps records might have been unavailable. If all respondents had given responses to all the questions, the quantities of PFOS used may have been higher.

Nevertheless, even though the quantities of PFOS in stock were much higher than the quantities of PFOS that have been used, and the uses were localised, there is still a cause for concern because POPs are mobile and can travel long distances from where they originally entered the environment. It would therefore be quite possible for the PFOS used for fire fighting to be dispersed over a larger area, exposing larger numbers of people to the chemical. For PFOS in particular the contamination of ground water and related drinking water is a risk. It is therefore necessary to ensure reduction towards final elimination of PFOS and related chemicals use.

ii. Management of PFOS and PFOS wastes from Fire-fighting Foams

Of the four respondents that described their usage and / or management of fire-fighting foam, two indicated that the waste generated was deposited in the area, while the third indicated that the used foam flows into storm water drains or is deposited in the area, and the fourth indicated that the waste is destroyed in a waste treatment facility. All the respondents also indicated that none of the sites where FFF has been used, has ever been tested for contamination. Given the fact that the wastes from the FFF are not properly managed, it would be prudent to test the sites where the FFF has been used, for environmental contamination. In addition, the areas need to be assessed for potential ground water contamination and possible impact on drinking water.

b. **Other Expected Sources of PFOS**

Several sources of PFOS and related chemicals had been expected, and questionnaires were sent to all such sources, with face-to-face interviews being held in some cases. None of the expected sources was found to use PFOS-containing substances, as indicated below.

Aviation Hydraulic Fluid

Data on aviation hydraulic fluids could not be obtained from the airports, as they responded to questions pertaining to aviation hydraulic fluids as “not applicable”.

Chemical Industry (Paints and Cleaning Chemicals)

The companies that had been expected to use PFOS and related chemicals all indicated that they did not use any PFOS and related chemicals.

Electroplating Industry

The metal plating industry is currently depressed and has low production. The one company that responded indicated that it uses chromium trioxide for electroplating, and not PFOS and related chemicals.

Pulp and Paper Industry and treated products

The one company in paper industry indicated that they do not use any PFOS-containing chemicals. However, treated paper used for baking paper, muffin cups, fast food wrapping and other purposes might have contained PFOS in the past. Therefore, such paper would have entered landfills and dumpsites.

Synthetic Carpets
Traders in synthetic carpets were not aware of the processes used to manufacture the carpets, so the use of PFOS and related chemicals in this process could not be ascertained. The presence of industries involved in recycling of synthetic carpets could also not be ascertained. However, stockpiles of synthetic carpets are present in Zimbabwe. A share of the synthetic carpets, in particular those produced before 2002, likely contains PFOS related substances.

Pesticides (sulfuramide)
The pesticide sulfuramide is not registered in Zimbabwe.

c. **Recommendations for Improved PFOS Management in Zimbabwe**

The inventory revealed that the major and significant source of PFOS and related chemicals in Zimbabwe are the fire-fighting foams. However, the other sources cannot be completely ruled out, such as the synthetic carpets. The inventory also showed that wastes containing PFOS and related chemicals are not managed in an environmentally sound manner. The following recommendations for improving the management of PFOS are therefore proposed:

i. There is a need to restrict the use of PFOS in all applications since alternatives are available. However, since Zimbabwe has such large quantities of PFOS-contaminated fire-fighting foams in stock, there is need for stakeholders to assess whether the country should apply for exemptions for the use of the foams which are currently in stock.
ii. There is need to promote the use of PFOS-free fire-fighting foams, especially among the local authorities and mining companies in Zimbabwe. This should be achievable, considering that airports in Zimbabwe are already using PFOS-free fire-fighting foams. It will therefore be necessary to raise awareness among the local authorities on the need to move away from PFOS-containing fire-fighting foams. It will also be necessary to come up with a programme to replace the fire-fighting foams in stock with new, PFOS-free foams, and dispose of the current stockpiles in an environmentally sound manner, if the exemption referred to in (i) does not go through.
iii. There is need to monitor the environment where PFOS-containing fire-fighting foams have been applied, in order to check for contamination in particular in respect to ground water contamination.
iv. One area where PFOS and related chemicals contamination may be expected to occur is the groundwater close to waste disposal sites since PFOS containing wastes like carpets and textiles have been disposed of in the past. It will be necessary to monitor such areas for contamination.
v. A more detailed PFOS and related chemicals inventory should be carried out, focusing on areas such as possibility of PFOS and related chemicals from the synthetic carpet industry and the stock of synthetic carpets in use, and also the chemical industry.
vi. All per- and polyfluorinated alkylated substances (PFAS) are a priority area of concern in SAICM and therefore should be addressed in future together with further assessments of PFOS.

2.1.16 Assessment with respect to Annex A Industrial Chemicals - Polychlorinated Biphenyls (PCBs)

An inventory was carried out in order to determine the amount of PCBs in Zimbabwe. The inventory was carried out under the initial NIP development project in 2011. The inventory was not updated under the current NIP Update project, mainly because of limited resources for conducting fieldwork. The 2011 inventory will therefore be reported on in this NIP, since it is the most recent for Zimbabwe.

Zimbabwe is however, participating in a regional project aimed at disposing of PCBs from the southern African region. The five-year project, which commenced in October 2016, has a component for verifying PCB inventories in the participating countries, and it is expected that this inventory verification exercise will provide more up-to-date information on the levels of PCB contamination in Zimbabwean transformers and capacitors.

The 2011 inventory focused only on PCBs in electrical equipment, which are found in three categories – the pure PCB transformers, the PCB capacitors, and the PCB-contaminated oil transformers. Although the PCB inventory attempted to quantify the amount of PCBs in Zimbabwe in terms of the three categories, the main focus was on PCB- contaminated oil transformers, which are expected to make up the bulk of contaminated equipment requiring destruction. From studies elsewhere in the world, it has been noted that the quantities of PCBs from the other two categories – pure PCB transformers and PCB capacitors – are fairly small in comparison to the PCB-contaminated oil transformers, and hence can often be exported abroad for destruction. The Zimbabwe PCB inventory was conducted on a small part of the country, since it was not possible to cover the whole country all at the same time due to budgetary constraints.

The owners of transformers in Zimbabwe can be split into four general categories, namely

- The utility sector (the major owner);
- Big industries with own power generation;
- Other industries with their own transformers (but no power generation); and
- Companies that repair transformers or scrap them.

2.1.16.1 Utility sector in Zimbabwe

There is one power utility in Zimbabwe, the Zimbabwe Electricity Supply Authority (ZESA). Zesa has four subsidiary companies, namely:

- The Zimbabwe Power Company (ZPC), responsible for power generation. ZPC operates five power stations (one being a hydroelectric power station, and the other four being thermal power stations).
- The Zimbabwe Electricity Transmission and Distribution Company (ZETDC), responsible for the transmission and distribution of power;
- ZESA Enterprises, responsible for manufacture and repair of transformers and other equipment used in the transmission and distribution of power; and
- Powertel, responsible for telecommunications.

2.1.16.2 Ownership of Transformers in Zimbabwe

ZETDC owns the majority of transformers in Zimbabwe, and has about 39,000 transformers, of which approximately 400 are transmission transformers and 38,600 are distribution transformers. There are about 3,000 other transformers owned by ZPC and other private companies bringing the total number of transformers to about 42,000. The transformers in Zimbabwe range in age from those manufactured in the 1930s to some manufactured as late as 2011.

2.1.16.3 Inventory Results

During the field inventory exercise, oil samples were collected from 505 transformers and analyzed for PCB contamination. Of these 505 samples, 39 were found to be PCB contaminated, representing an approximate 8% contamination level of transformers in Zimbabwe. A transformer is said to be PCB-contaminated if it has an Askarel (PCB) concentration greater than or equal to 50 parts per million (ppm). The PCB concentrations of the contaminated transformers ranged from 50 – 600 ppm.

The ages of the contaminated transformers ranged from those manufactured in 1936, to some manufactured in 2007. Several pure PCB capacitors were also noted during the field inventory exercise, particularly at mineral processing operations. No pure PCB transformers were noted during the field visits, but they are expected to be present in the country. The properties of the contaminated transformers are described in Table 12. As will be noted in the table, information for some of the transformers is missing. This is because the name-plates on some of the transformers were missing, or were unclear; hence some of the information could not be captured.

Table 12: Summary Description of Contaminated Transformers

Manufacturer	Year of Manufacture	Power	HV/ LV (kV)	Cooling type	Total Weight	Liquid Weight/ Volume	Chloride Reading	PCB (Askarel) Concentration in ppm	Sector
							80.0	101	National Electricity Utility - Transmission and Distribution
C.A. Parsons and Co.	1984	300 KVA	3.3/0.4 kv	onan	2,700 kg	900 kg	57.9	73.4	Private Company
Alstom	2001			onan	800 kg	290 kg	39.1	50.0	National Electricity Utility - Transmission and Distribution
							163	206	National Electricity Utility - Transmission and Distribution
South Wales	1977	500 KVA	11/0.4 kv	onan	2,727 kg	822 L	52.4	66.4	National Electricity Utility - Transmission and Distribution
First electric Central Africa Ltd		500 KVA	11/0.4 kv	onan	7,000 lbs (3,181 kg)	222 gal	49.8	63.1	National Electricity Utility - Transmission and Distribution
Bonar, Longman and Co.		500 KVA	11/0.4 kv	onan	1,470 kg	195 gal	58.9	64.5	National Electricity Utility - Transmission and Distribution
Constructions Electriques Du Centtre (Celduc)	1981	500 KVA	10.5 /0.64 kv	onan	1,920 kg	1020 L	52.5	66.6	National Electricity Utility - Power generation
Celduc	1981	500 KVA	10.5 /0.64 kv	onan	1,920 kg	385 kg	295	374	National Electricity Utility - Power generation
Celduc	1981	500 KVA	10.5 /0.64 kv	onan	1,920 kg	385 kg	162	206	National Electricity Utility - Power generation
English Electric IDD	1936	35,500 KVA		onan	57,000 kg	2,600 gal	40.5	51.3	National Electricity Utility - Power generation
Bonar Long	1954	300 KVA		onan	2,260 kg	145 gal	53.2	67.5	National Electricity Utility - Power generation
	1959	1000 KVA	33/11 kv	on	11,189 lbs (5,085 kg)	3,645 lbs	49.0	62.1	Mining / Mineral Processing

Manufacturer	Year of Manufacture	Power	HV/ LV (kV)	Cooling type	Total Weight	Liquid Weight/ Volume	Chloride Reading	PCB (Askarel) Concentration in ppm	Sector
						(1,657 kg)			
	1953	500 KVA	33/0.55 kv	on	4,562 kg	1,430 kg	39.9	50.6	Mining / Mineral Processing
		1000 KVA	33/3.3 kv	on	15,480 lbs (7,036 kg)	4,919 lbs (2,236 kg)	45.2	57.3	Mining / Mineral Processing
	1981	1000 KVA	11/0.525 kv	onan	3,630 kg	890 kg	76.0	96.3	Mining / Mineral Processing
Stromberg (Finland)	1989	5 MVA	33/12 kv	onan	11,000 kg	2,550 kg	50.8	64.3	National Electricity Utility - Transmission and Distribution
Mecco	1971	25 KVA	11/0.4 kv	onan	920 lbs (418 kg)	26	63.6	68.0	National Electricity Utility - Transmission and Distribution
South Wales		1000 KVA	11.5/0.55 kv	onan	8373 lbs (4,033 kg)	1,137 L	117	148	Mining / Mineral Processing
South Wales	1972	200 KVA	11/0.4 kv	onan	1,430 kg	479 kg	45.5	57.7	National Electricity Utility - Transmission and Distribution
Nical	2008	100 KVA	0.55/0.38				62.9	79.7	Mining / Mineral Processing
South Wales	1981	50 KVA	11/0.4 kv	o.n	495 kg	182 kg	48.5	61.4	National Electricity Utility - Transmission and Distribution
Shandong Dachi electric (China)	2007	1000 KVA	11/0.4 kv	onan	2,740 kg		169	239	National Electricity Utility - Transmission and Distribution
	1995		0.55/0.38 kv		1190	460 L	43.4	55.0	Mining / Mineral Processing
Dimako	2007	100 KVA	0.55/0.4 kv	onan	850kg	290 L	177	225	Mining / Mineral Processing
Mecco	1974	25 KVA	11/0.4 kv	onan	920 lbs (418 kg)	29 gal	49.1	62.2	National Electricity Utility - Transmission and Distribution

Manufacturer	Year of Manufacture	Power	HV/ LV (kV)	Cooling type	Total Weight	Liquid Weight/ Volume	Chloride Reading	PCB (Askarel) Concentration in ppm	Sector
South Wales	1968	1000 KVA	11/2.2 kv	on	8,716 lbs (3,961 kg)	2,414 lbs (1,096 kg) /282 gal	72.0	91.3	Mining / Mineral Processing
Nical	2005	2500 KVA	33/11 kv	onan	10,590 kg	3,440 L / 2,954 kg	58.1	73.6	Mining / Mineral Processing
South Wales	1981	250 KVA	2.2/0.55 kv	onan	1,240 kg	348 kg	129	164	Mining / Mineral Processing
							68.0	86.2	Mining / Mineral Processing
Electricity Supply Commission Southern Rhodesia	1936	100 KVA	2.2/0.4 kv	onan			56.0	70.9	Mining / Mineral Processing
Nical	2002	1000 KVA	11/0.55 kv	onan	3655	785 / 915L	408	518 / 504	Mining / Mineral Processing
South Wales	1970	1000 KVA	11/0.55 kv	onan	8114 lbs (3,688 kg)	2017 lbs (917 kg)		600	Mining / Mineral Processing
Nical	2002	1000 kKVA	11/2.2 kv	onan	3690	796		475	Mining / Mineral Processing
	1966	50 KVA	2.2/3.8 kv	onan	1,287	50 gal	114		Mining / Mineral Processing
	1990	7500 KVA	33/11 kv	onan	15,140	3,500 kg	43.8	55.5	National Electricity Utility - Transmission and Distribution
				onan			43.1	54.6	Mining / Mineral Processing
	1970	1000 KVA	11/2.2 kv	onan	8114 lbs (3,688 kg)	2071 L	50.5	66.6	Mining / Mineral Processing
						73.94	51.2	64.9	Mining / Mineral Processing

(Source: MENRM, 2012 – PCB Inventory Report for Zimbabwe 2011)

Due to the limited budget, a very small sample size of about 1.2% of the total number of transformers in Zimbabwe was used, and a random sampling method was used to collect the samples. The 8 % PCB contamination rate that was obtained was therefore not very conclusive due to the small sample size and the sampling methodology. A more detailed inventory, which makes use of a stratified random sampling procedure, would need to be carried out in order to ensure the production of an accurate inventory on the PCB contamination status for Zimbabwe.

The inventory was, however, very useful in that it showed that PCB contamination is not limited to the pre-1980 transformers, as had been expected, but even those with a manufacture year of 2007 (more than 20 years after the manufacture of PCBs had been discontinued) could still be contaminated. This suggests that PCB cross-contamination could be occurring possibly during servicing of transformers. The inventory again showed that contamination is not limited to the smaller distribution transformers as had been expected, but even the big transmission transformers (in this case a 57-tonne transformer was found to be contaminated).

The inventory also showed that in a number of instances, decommissioned transformers and capacitors were stored poorly, and there was a lot of leakage of oil into the bare soil. It can thus be concluded that poor storage of decommissioned electrical equipment which contains oil is leading to environmental contamination by oil which could possibly be PCB contaminated.

Other Uses of Transformer Oil in Zimbabwe

There is a lot of transformer oil theft in Zimbabwe. When questioned on what they use it for, the culprits indicated that it is sold and used for the following:

- as a coolant for welding machines;
- it is mixed with diesel to increase the quantity of diesel; and
- it is also sold as cheap cooking oil.

Members of the public are therefore at a very high risk of exposure, particularly given the fact that it is sold as cheap cooking oil to unsuspecting members of the public.

Recommendations from the PCB Inventory

The PCB inventory identified some issues of concern, and came up with the following recommendations:

i. There is need to conduct a full-scale inventory of PCBs, and conduct environmentally sound disposal of all identified PCB oils and PCB-contaminated equipment.
ii. There is need to review the legislation and include the management of PCBs in the legislation for hazardous chemicals and wastes.
iii. There is need to raise awareness on the sound management of PCBs (particularly storage) among stakeholders and the general public.
iv. A number of the transformer storage sites do not meet environmentally acceptable standards, and there is therefore need to improve these storage sites, and monitor them for PCB contamination.

2.1.17 Assessment of Releases from Unintentional Production of Annex C Chemicals – Unintentionally Produced POPs (U-POPs)

2.1.17.1 Composition of U-POPs Emission Sources in Zimbabwe

An inventory of U-POPs was carried out in 2016 to determine the amounts of U-POPs released from the different sources. The UNEP Toolkit (2013 version) was used to calculate the estimated amounts released. The UNEP Toolkit divides the sources of U-POPs into 10 main source groups, which are further divided into subcategories. The emissions of U-POPs are therefore calculated for each subcategory, from which the subcategories / sources that contribute the highest emissions of dioxins / furans can be addressed, so that they can receive the most urgent attention in terms of measures for reduction.

Since a U-POPs inventory had previously been carried out in 2012, there was need to compare the results from the 2012 inventory with the current 2016 inventory, to see if there were any significant changes in emissions. The 2012 inventory had been conducted using the earlier 2005 version of the UNEP Toolkit, and so the data from the 2012 inventory was recalculated using the 2013 Toolkit, so that the results could be comparable.

The results for the two inventories are summarised in Table 13. The unit of measurement used is grams of toxic equivalent per annum (g TEQ/annum), which is a measure of the amount of PCDD/PCDF released from the particular process. The 2016 inventory used improved methods of data collection, hence more accurate data was collected, and from more source categories.

Table 13: Summary of U-POPs Emissions in Zimbabwe, by Sector

Category	Subcategory / Source	Emission for 2012 Inventory in g TEQ/a (recalculated)	Source Emission as Percentage of total emission for 2012 inventory (%)	Emission for 2016 Inventory in g TEQ/a	Source emission as percentage of total emission for 2016 inventory (%)
Waste Incineration	Medical Waste burning	1.22	2.30	3.70	5.97
	Animal Carcass Burning	No data	n/a	0.09	0.15
Ferrous and Non-ferrous metal production	Iron and Steel Production Plants and Foundries	0.01	0.02	0.03	0.04
	Aluminium Production	0.16	0.30	0.13	0.20
	Lead Production	No data	n/a	0.12	0.19
	Thermal Wire Reclamation	No data	n/a	0.22	0.35
Heat and Power generation	Fossil Fuel Power Plants	1.40	2.64	3.75	6.06
	Biomass Power Plants	No data	n/a	9.24	14.93
	Household Heating and Cooking with Biomass	No data	n/a	5.63	9.10
Production of mineral products	Cement Production	0.04	0.08	0.04	0.07
	Brick Production	0.17	0.32	0.17	0.27
	Glass Production	No data	n/a	0.00	0.00
	Asphalt Mixing	No data	n/a	0.00	0.00
Transportation	4-Stroke Petrol Engines	0.04	0.08	0.00	0.01
	Diesel Engines	0.08	0.15	0.08	0.12
Open Burning Processes	Biomass Burning	4.26	8.03	2.90	4.68
	Waste Burning and Accidental Fires	45.55	85.88	33.04	53.39
Production and Use of Chemicals and Consumer Goods	Pulp and Paper Production	No data	n/a	0.01	0.02
	Use of Chlorinated Aromatic Chemicals	No data	n/a	0.05	0.07
Miscellaneous	Crematoria	No data	n/a	0.01	0.02
	Dry Cleaning	0.00	0.00	0.00	0.00
	Tobacco Smoking	0.00	0.00	0.00	0.00
Disposal	Landfills, Waste Dumps and Landfill Mining	No data	n/a	2.31	3.73
	Sewage / Sewage treatment	0.11	0.21	0.37	0.60
Total		**52.86**	100.00	**61.88**	100.00

From the inventory process, it was noted that the sectors that made the biggest contributions to dioxin/furan emissions for 2016 were as follows:

1. Waste burning and accidental fires	53.39 %
2. Biomass power plants	14.93 %
3. Household heating and cooking	9.10 %
4. Fossil fuel power plants	6.06 %
5. Medical waste burning	5.97 %
6. Biomass burning	4.68 %
7. Landfills and Waste Dumps	3.73 %
8. Sewage / sewage treatment	0.60 %
9. Thermal wire reclamation	0.35 %
10. Brick production	0.27 %
11. Aluminium production	0.20 %
12. Lead production	0.19 %
13. Animal carcass burning	0.15 %
14. Diesel Engines	0.12 %

An increase of the PCDD/PCDF emission levels can be observed in the 2016 inventory compared to 2012 recalculated inventory. The main reason was that the 2016 inventory used improved methods of data collection, hence more accurate data was collected and from more source categories.

a. **Analysis of U-POPs Releases by Sector**

Main Category 1 – Waste Incineration

Sub category - Hospital Waste Incineration
Medical Waste Incineration contributes a significant amount of PCDD/PCDF release of 3.7 g TEQ/annum. This figure was calculated using data from the six referral (central) hospitals in the country.

The calculated emissions for medical waste incineration were fairly high, but figures given are expected to be an underestimation, considering that emissions were only calculated for central hospitals (which cater for the largest number of people). There are other government health facilities, which include the provincial hospitals, the district hospitals, and the rural health centres. There are also a number of private hospitals. All these facilities cater for a significant percentage of the population, and are therefore expected to produce a significant amount of waste (which was not included in the inventory). Again, the incinerators for some of these health establishments are in a poor condition, hence the actual amount of emissions from hospital waste incineration in Zimbabwe is expected to be much higher than what was calculated. People living in the proximity of the incinerators may become exposed to these PCDD/PCDF releases, hence there is need to improve the incineration processes.

Sub category – Animal Carcass Burning
The burning of animal carcasses contributes a fairly low amount of dioxin PCDD/PCDF release of 0.093 g TEQ/a. This was calculated from the 10 tonnes per annum that are incinerated by the Government's Veterinary and Livestock Department at their state of the art incinerator plus the estimated 186 tonnes that are burned elsewhere in the country using crude incinerators or out in the open.

Main Category 2 – Ferrous and Non- Ferrous Metal Production

Subcategory – Iron and Steel production
Although Zimbabwe has a huge iron and steel production facility, ZISCOSTEEL (the Zimbabwe Iron and Steel Company), at the time of the inventory, the giant steelmaker was not producing. However, Zimbabwe has several ferrochrome processing companies and these were added to the iron and steel plants subcategory. For the 2016 inventory, the emissions from these companies contributed a fairly low amount of 0.026 g TEQ/annum.

Subcategory – Aluminium production
Data for this category was received from a secondary aluminium processing firm, and the total emissions from the sector were fairly low, at 0.13 g TEQ / annum.

Subcategory – Lead production
Data for this category was received from a secondary lead processing firm, and the total emissions from the sector were also fairly low, at 0.12 g TEQ / annum.

Subcategory – Thermal wire reclamation
Data for this category was received from the one big company which practices this activity on a formal scale, and the total emissions from the sector were fairly low, at 0.22 g TEQ / annum.

Main Category 3 – Power Generation and Heating

Subcategory - Fossil Fuel Power Plants
Zimbabwe has four fossil fuel power plants which generate electricity for the nation. In all these power plants, bituminous coal is used to generate electric power. The calorific value of bituminous coal ranges between 24MJ/kg and 33MJ/kg. The fossil fuel power plants contributed a high amount of PCDD/PCDF (3.75 g TEQ/annum).

Subcategory – Biomass Power Plants
Mixed biomass power boilers are found in Zimbabwe mainly in the timber and sugar industries. These industries burn the waste from their process and generate energy. The emissions from these plants were high, at 9.24 g TEQ/annum.

Subcategory- Household heating and cooking
The use of wood fuel for cooking is very common in Zimbabwe, and wood is used by the majority of people in the rural areas of Zimbabwe where about 65 % of the population live. Only 13% of the rural population has electricity, implying that 87% of the rural population use wood fuel for cooking. The use of wood fuel is also quite common in the urban areas at times,

especially when there are power cuts, or when households prefer to use wood for cooking because it will appear to be cheaper than using electricity.

The use of wood fuel for heating and cooking produced high amounts of PCDD/PCDF at 5.63 g TEQ/annum. This poses a serious concern, considering that the majority of the population rely on this type of fuel. Given that use of this wood fuel also gives rise to polycyclic aromatic hydrocarbons (PAHs), there is need for the Government to promote and provide for cleaner energy sources, in order to protect human health

Main Category 4 – Mineral Production

Subcategory - Cement Production
There are three major cement manufacturing plants in Zimbabwe, which all use the dry process. The contribution of cement plants to PCDD / PCDF release was found to be fairly low (0.043 g TEQ/annum). This was most likely due to the process type used (dry process with low emission factors). In addition, the pollution abatement technologies at all plants were appropriate.

Sub category - Brick production
The total number of bricks produced in Zimbabwe annually (according to the Zimbabwe National Statistics Agency) is 255,614,667, which is approximately 766,844 tonnes. The total emission of PCDD/PCDF from this activity was estimated to be 0.17 g TEQ/annum.

The PCDD/PCDF releases were calculated based on data received from the registered brick making establishments. There are, however, numerous unregistered brick making establishments throughout the country, as brick making is a brisk business, and is a major source of income for a number of informal producers. The calculated emissions are therefore an underestimation of what is present in the country.

While some of the bigger registered establishments use coal for making bricks, the smaller unregistered establishments usually use wood, and in some cases may even use treated waste wood. These small-scale establishments often operate in the residential areas, hence there is a high risk of PCDD/PCDF and other release (PAHs and particles) exposure for the residents living near these establishments.

Subcategory – Glass production
The glass production industry contributed an insignificant amount of PCDD/PCDF emissions, at 0.002 g TEQ/annum.

Subcategory – Asphalt Mixing
The asphalt mixing industry also contributed an insignificant amount of PCDD/PCDF emissions at 0.00084 g TEQ/annum. Although the PCDD/PCDF emissions were insignificant, this sector is known to emit carcinogenic PAHs, hence it should not be ignored.

Main Category 5 – Transport

The transport sector contributes a low amount of dioxin emissions in Zimbabwe (0.004 g TEQ/annum for petrol, and 0.077g TEQ/annum for diesel). However, the number of vehicles in the country is increasing, implying that the contribution of the transport sector to the release of PCDD/PCDF and other releases is expected to increase.

Main Category 6 – Uncontrolled Combustion / Open Burning Processes

Subcategory – Biomass Burning
This subcategory includes grassland fires, forest fires, burning of agricultural residues and pre-harvest burning of sugar cane). It contributes a significant amount of dioxins (2.90 g TEQ/annum).

The grassland and forest fires are very common, and occur throughout the country, particularly in the dry windy season, resulting in an even greater dispersion of PCDD/PCDF and other emissions. The magnitude of the problem is high, considering that in 2015, a total of 1,510,343 hectares were burned, which is approximately 4% of the total land area of 39,075,700 hectares for Zimbabwe. It is therefore imperative that measures to control and reduce the incidence of veldt fires be employed, if the releases of PCDD/PCDF are to be reduced.

Considering the fact that these grassland and forest fires are not confined to specific areas but occur all over the country, it means that ordinary people from all walks of life are exposed to emissions from this process.

Subcategory – Waste Burning
This subcategory includes waste that is burned at the domestic level and at landfills, as well as all accidental fires in houses, factories, and cars. It contributes the highest sources of PCDD/PCDF by far in Zimbabwe. In the 2016 inventory, the sector produced 33.04 g TEQ/annum of PCDD/PCDF, which accounts for 53.4% of all PCDD/PCDF emissions in the country. Since the waste that is burned is un-segregated, and is composed of plastic, paper, leather, textiles, bottles, kitchen waste, garden waste, e-waste and other hazardous waste, the potential for PCDD/PCDF release from burning of this mixed waste is therefore very high.

Burning of waste in residential areas is a common practice especially in areas where waste may not be collected on a regular basis. In many cases local authorities are unable to collect all the waste that is produced, hence the residents end up burning the waste, usually in their backyards. Many residents actually believe that burning of waste is an acceptable method of managing waste despite the several awareness raising programmes that have been conducted in attempting to educate them otherwise. The residents may also dump the uncollected waste in open spaces close to their homes, and burning of these small illegal dumps is common. The fact that this practice takes place in the residential areas means that a large percentage of the population is exposed to the emissions of PCDD/PCDF and other toxic releases.

When the local authority does collect the waste, it is dumped at the municipal ‘landfills’, and many of the ‘landfills’ are simply formalized dumpsites. Landfill fires are quite common at these dumpsites, since there is no collection of landfill gas. The landfill fires can go on for weeks,

exposing residents in the vicinity to PCDD/PCDF releases. Poor waste management is therefore one of the biggest environmental problems affecting Zimbabwe, and it will need to be addressed in order to reduce the exposure of the general populace to PCDD/PCDF, other releases and the toxic ashes scattered all over the country.

The application of the waste management hierarchy has not yet taken off among the general public. It is mainly practiced by those organizations that have management systems such ISO 14001 and ISO 9001 in place.

Main Category 7 – Production and Use of Chemicals and Consumer Goods

Subcategory - Pulp and Paper Mills
The pulp and paper industry in Zimbabwe is currently depressed, with the major companies being out of operation at present. Data for this activity was obtained from only one company, and the calculated emissions showed a low contribution to PCDD/PCDF emissions, at 0.012 g TEQ/annum.

Subcategory – Use of Chlorinated Aromatic Chemicals
In Zimbabwe, there is no production of such chemicals, but they are used as pesticides. It is expected that their use will result in the release of PCDD/PCDF emissions, since the chemicals themselves are expected to have certain levels of PCDD/PCDF, depending on how they were produced.

One such chemical is 2,4-D, which is used in agriculture as a herbicide. The inventory showed that about 8.12 tonnes of the chemical are used per annum, which, when calculated, would release 0.046 gTEQ/annum of PCDD/PCDF emissions. This emission level was regarded as low.

Main Category 8 – Miscellaneous

Subcategory – Crematoria
Cremation is practised in Zimbabwe but not on a large scale. There are only three towns in Zimbabwe that have crematoria, and these are Harare, Bulawayo and Kadoma. The 2016 inventory showed that PCDD/PCDF emissions from this sector were low, at 0.013 g TEQ / annum.

Subcategory - Dry cleaning
In Zimbabwe, the majority of dry cleaners handle normal and not heavy-duty textiles (99.99% normal), hence the emissions of PCDD/PCDF into the dry cleaning residues are much lower than they would have been if heavy duty textiles were handled. Calculations of PCDD/PCDF releases from dry cleaning gave an estimated 0.00045 g TEQ/annum of PCDD/PCDF. Although the overall figure appears very low, it becomes significant in that the dry cleaning residues are disposed of in the municipal sewer system, where they are discharged back into the environment after treatment. The general populace thus becomes exposed to this source of PCDD/PCDF and other pollutants including the perchloroethene used in dry cleaning.

Subcategory - Tobacco Smoking
In Zimbabwe in 2015, approximately 3.36 billion cigarettes were sold on the local market, and emissions from this sector were calculated to be 0.00034 g TEQ / annum. This is a very low emission value, and it can be assumed that the smokers and their families are most at risk from this source of PCDD/PCDF and the much higher amount of PAHs.

Main Category 9 – Disposal / Landfill

Subcategory – Landfills, Waste Dumps and Landfill mining
Data for this category was collected from nine urban local authorities, whose combined populations account for 80% of total urban population for Zimbabwe. It was noted that the nine local authorities disposed of a total of 457,325 tonnes of waste at the different dumpsites. That total amount of waste was calculated to give an emission of 2.31 g TEQ/annum of PCDD/PCDF. This figure was quite high, despite the fact that only domestic waste was taken into account.

Considering the fact that waste disposal from some of the other local authorities was not included in the inventory, this means that the emissions from this sector are higher than what was calculated. There is a need to promote uptake of the integrated waste management hierarchy in Zimbabwe, so as to reduce the amount of waste that is disposed of at landfills, and hence reduce emissions from this sector.

Subcategory - Sewage / Sewage treatment
Data for this sector was collected from eight urban local authorities, whose combined populations account for 77% of Zimbabwe's urban population. The different local authorities had different sewage treatment practices, with two having urban and industrial inputs with no sludge removal (total of 6,398,217,000 L of effluent), five having urban and industrial inputs with sludge removal (total of 98,451,582,000 L of effluent and 17,229 tonnes of sludge removed), and two having domestic inputs with sludge removal (total of 2,709,651,000 L of effluent and 474 tonnes of sludge removed). One local authority had two different types of sewage treatment plants.

Different emission factors were applied for the different sewage treatment systems, and the total emissions from this sector were calculated to be 0.374 g TEQ /annum. This figure is quite high, and a lot of people, especially urban dwellers are at risk of exposure since the treated sewage is discharged into water bodies from which a number of municipalities draw their drinking water.

Subcategory - Waste Oil Disposal
This activity is carried out on a very small scale in Zimbabwe, hence its contribution to PCDD/PCDF emissions can be assumed to be negligible. However, most of the waste oil is re-used and producers sell it off. Those who buy used oil use it for firing furnaces and making pesticides. The possibility of PCDD/PCDF release from the use of waste oil to furnaces is quite high if PCB-containing oil is used, and there is need to identify exact industries that practise this as a starting point to ensure reduction of the emissions.

Main Category 10 – Hot Spots

Subcategory - Production sites of chlorinated organics
In Zimbabwe, there is no production of chlorinated organics, chlorine, or chlorinated phenols. However, there are a number of pesticide formulation companies that are currently operating and have been operating in the past. The related formulation areas and related landfills can be considered a hotspot for pesticides and associated PCDD/PCDF contamination.

Subcategory - Timber manufacture and treatment sites
Timber manufacture and treatment is common in Manicaland Province of Zimbabwe. There are three major companies that grow timber, but the number of those that treat timber is much higher, since many smaller companies buy from the major growers and treat the timber on their own. The majority of those that treat poles use creosote, but lately this has been difficult to obtain, so some of the companies are turning to the use of Chromated Copper Arsenate (CCA) for treating poles. There is therefore a likelihood that the timber treatment sites could be contamination hotspots. Since in history some pentachlorophenol (PCP) might have been used for timber treatment, these areas can be considered as possibly contaminated.

Subcategory - PCB containing equipment
The preliminary PCB inventory conducted in Zimbabwe in 2011 did not identify any pure PCB transformers, although a number of PCB capacitors were identified. A lot of storage sites for transformers exist, and some of these were noted to be in a poor condition, with oil leaking into the ground. Since the PCB status of the transformers was not always known, storage sites for transformers appear to be a high risk area in terms of PCDD/PCDF and PCB contamination with potential of further emissions.

Subcategory - Dumps of waste/residues from categories 1 – 9
In Zimbabwe, industrial and domestic waste are usually dumped together at municipal dumpsites, hence the ordinary municipal dumpsites are potential hotspots for PCDD/PCDF. However, some of the waste produced is not accounted for at the landfill since it is disposed of into sewers and on open land in secluded areas as some companies try to avoid paying disposal tariffs to the Local Authority. This therefore means that there are several unknown hotspots throughout the urban areas from which PCDD/PCDF release is likely to occur.

Subcategory - Sites of relevant accidents
Sites of relevant accidents with generation of PCDD/PCDF, such as large scale fires of industries or larger constructions are registered by the fire-fighting services. Chemical accidents that occur within factory premises, however, are not so well monitored, since the onus is on the factory owner to report. If the owner does not report to the authorities, they have no way of knowing, hence the potential hotspots are not easily known. However since Zimbabwe does not have chemical industries producing chlorinated organics there is a minor risk of relevant accidents with high PCDD/PCDF release within the chemical industries.

Subcategory - Kaolin or Ball Clay Sites
Ball clay and kaolinic clays in different regions in the world can contain PCDD/PCDF with a specific PCDD dominated pattern (Ferrario et al. 2007, Horii et al. 2011). Kaolin samples from Africa have also been found to contain elevated levels of PCDD (Reeuwijk et al. (2013). Studies also show that the relatively high levels of PCDD/PCDF in human milk samples from Congo and

Ivory Coast are due to the use of the clay during pregnancy. Other countries with low contaminated clays seem not to have a relevant impact from this practice. In Zimbabwe clay is also used during pregnancy. PCDD/PCDF in ball/kaolinic clays, in particular from quarries where clays are used for human consumption or as animal feed additive, will therefore need to be evaluated.

b. **Recommendations for Reducing U-POPs emissions in Zimbabwe**

The U-POPs inventory identified a number of issues of concern, and came up with the following recommendations for addressing the issues of concern, and ultimately reducing U-POPs emissions:

i. Since waste burning and accidental fires are the biggest sources of PCDD/PCDF formation in Zimbabwe, it is critical to put in place measures to improve waste management so as to reduce the incidences of waste burning, and thus reduce the emissions from this sector. There is also need to restrict open waste burning by regulation and related implementation.
ii. The Government should make it a priority to promote clean energy sources in order to protect the population from exposure to emissions caused by household heating and cooking using biomass.
iii. Considering that most of Zimbabwe's electric power is produced by fossil fuel power plants (and the biomass power plants also play an important role in the Zimbabwean economy) there is need to put in place improved pollution abatement technologies in this sector in order to reduce emissions.
iv. Zimbabwe should take major steps to reduce biomass burning such as veldt fires and burning of agricultural residues.
v. It appears leaded fuel is still being imported into the country, but this should have stopped a long time. There is need to investigate the uses of leaded fuel in Zimbabwe, and eliminate its use altogether.
vi. There is need to introduce Best Available Techniques / Best Environmental Practices (BAT / BEP) in controlled incineration (such as medical waste incineration) and industrial processes such as thermal wire reclamation, brick production, aluminium production and lead production.
vii. It is also important that improved methods of sewage treatment be applied, in order to reduce emissions from this sector.
viii. The contaminated sites are a potential major source of PCDD/PCDF, but there is no empirical evidence to support their existence or extent. There is need to carry out an inventory of contaminated sites, so that information on their extent can be used as a basis for developing and implementing appropriate interventions for their proper management.

The action plans to be developed in the NIP need to take into account the recommendations, so as to enable Zimbabwe to make strides towards protecting its people and environment from the effects of U-POPs produced by the identified sectors.

c. Lessons Learnt and Recommendations for Improved U-POPs Inventorying

A number of lessons were learnt in conducting this inventory, which, if adopted, should improve the process of conducting and / or updating U-POPs inventories. These include:

i. Synergies with the GHG Inventory Process

Many of the U-POPs are produced in much the same way as greenhouse gases (GHGs), and activity data on GHG emissions are regularly collected for the National Communication to the United Nations Framework Convention on Climate Change (UNFCCC). Since both the GHG inventories and the U-POPs inventories are usually conducted by the Environment Ministry, there is need for these units to work together and collect the activity data simultaneously so as to, on one hand, correlate the activity data and emissions estimates, and on the other hand, avoid duplication of efforts, and thus use available resources efficiently. The different calculations can then be conducted by the different task teams.

ii. Development of Databases for Chemicals Inventories

There is need for the setting up of chemicals databases for inventory data. The requisite inventory data should be provided regularly by producers, and fed into the database. That will allow countries to update inventories of U-POPs regularly without necessarily seeking additional resources to collect data for conducting inventories.

2.1.18 Information on the State of Knowledge on Contaminated Sites and Wastes

An inventory of contaminated sites has not been carried out in Zimbabwe, although certain sites are known / suspected to be contaminated. These include sites that have been contaminated by certain POPs and other different types of hazardous chemicals. Transformer storage sites are often poorly kept, and given the fact that only a small fraction of transformers have been tested for PCBs, chances of these transformer storage sites being PCB-contaminated sites are quite high. Other known contaminated sites include those that have been contaminated as a result of pesticide spillages. Suspected contaminated sites include timber treatment sites, sites where fire-fighting foam has been used, and areas where there is a lot of artisanal and small-scale gold mining (ASGM) using mercury. All municipal waste dumps and the surrounding areas are expected to be contaminated, since the majority of the dumpsites are not lined, and thus leachate is expected to seep through into the ground. Chemical spillages often occur as a result of road traffic accidents, and areas where these occurred in the past might also be expected to be contaminated. In recent years, (since about 2010) the Environmental Management Agency has been ensuring that sites of chemical spillages are cleaned up.

There are a number of areas in the country which are known to be contaminated, and numerous areas which are suspected to be contaminated. The presence of these contaminated areas results in high risk of exposure for the public, either through contamination of groundwater, or through uptake of contaminants by plants resulting in contaminants entering the food chain. In order to protect human health from exposure to these contaminants, it is necessary to identify and remediate all the contaminated sites.

2.1.19 Current Level of Information, Awareness and Education

As far as chemical risks are concerned, awareness at different levels of those who come across chemical substances is of paramount importance. This section provides an overview of the mechanisms available for providing information to workers and the public in relation to the potential risks associated with chemical production, importation, exportation, use and handling and capacity for training and education of target groups affected by chemicals. The section also provides information on levels of awareness of POPs issues among workers and members of the public.

2.1.19.1 Instruments for Creating Awareness on Chemical Management

There are a number of legal instruments and policies available for the proper regulation and management of chemicals. All these instruments require that awareness-raising on sound chemicals management be undertaken. The instruments include:

- Environmental Management Act Chapter 20:27 and the associated regulations;
- The Fertilizer, Farms Feeds and Remedies Act Chapter 18:12 and associated regulations;
- The Factories and Works Act Chapter 14:08 and its regulations, namely Regulation 262 on Registration and Control of Factories Section 14 and General Regulations 263;
- NSSA Statutory Instrument 68 of 1990 on Accident Prevention and Workers Compensation, 3rd Schedule;
- International Labour Organization (ILO) Convention 170 on Safety in the Use of Chemicals and its recommendation and Convention 155 on Occupational Safety and Health;
- ILO Convention 187 on the Promotional Framework on Occupational Safety and Health and its recommendations;
- The National Environmental Policy;
- The National Integrated Waste Management Plan; and
- The National OSH Policy.

2.1.19.2 Government Institutions with a Mandate for Raising Awareness for Chemicals Management

A number of Government institutions are mandated with creating public awareness on hazardous chemicals management. These include:

a. **Ministry of Environment, Water and Climate**, which conducts awareness raising through, among other things, commemorating environmental days such as World Environment Day, World Ozone Day, Africa Environment Day;

b. **The Environmental Management Agency (EMA),** which conducts awareness campaigns on a wide range of issues including sound management of waste, hazardous waste and hazardous substances. EMA uses a wide range of tools, including both the print and electronic media. EMA licences the use, storage and transportation of hazardous substances, as well as the disposal of hazardous waste. In this role, it creates awareness among licensees on best practices for the environmentally sound management of hazardous

substances and wastes. It also recommends to Government, which Conventions the country should ratify.

The Hazardous Substances, Pesticides and Other Toxic Substances Regulations, which are administered by EMA, require that manufacturers, importers and transporters of hazardous materials should provide detailed labelling with warning symbols, directions for use, composition, precautions, first aid, compatibility, warranty, disposal and emergency information. This is a good awareness-raising tool.

c. **The National Social Security Authority (NSSA)** promotes occupational safety and health in all industries including those dealing with hazardous chemicals. In carrying out this mandate, the main focus is to protect workers' safety and health. Major promotional programmes carried out by NSSA include:
   - Conducting annual occupational safety and health conferences, workshops and seminars, drawing participants from industry and public service workers;
   - Company specific teach-ins (safety talks) on various OSH topics are discussed with specific company workers and in some cases safety talks focus on chemicals management;
   - Conducting surveys and risk assessments of workplaces, and pointing out hazards and risks associated with workplace hazards including hazardous chemicals;
   - Training on a diverse range of OSH topics, key among them being chemical safety and health management. Currently, some workplaces dealing with chemicals are being trained on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), adopted by SADC member states;
   - Publishing the On-Guard magazine, which raises awareness on a number of OSH issues, including chemicals management issues; and
   - Conducting the 8-week training course on Occupational Safety, Health and Environmental Management Course (OSHEMAC), which course includes aspects of safety in the use of chemicals. The target group for this course is industry personnel dealing with OSH issues.

d. **The Ministry of Agriculture, Mechanization and Irrigation Development**, through the Department of Research and Specialist Services, and the Department of Agricultural, Technical and Extensions Services (Agritex), promotes the safe and wise use of pesticides.

2.1.19.3 Non Governmental Organizations (NGOs) Efforts to Educate the Public

In addition to the Government departments, there are also a number of NGOs whose operations promote awareness on chemicals management. These include:

a. **Labour Organizations**

The Zimbabwe Congress of Trade Unions (ZCTU), the Zimbabwe Federation of Trade Unions (ZFTU) and the Zimbabwe Chemicals and Plastics Allied Workers Union (which is an affiliate of ZCTU), have Occupational Health and Safety Departments which conduct awareness workshops, seminars and exhibitions for workers in chemical industries and the farming sector. Chemical and agro-chemical management are among the issues addressed during the awareness-raising sessions.

b. **Standards Association of Zimbabwe (SAZ)**

SAZ facilitates the development of national standards and encourages their implementation in order to enhance Zimbabwe's competitiveness and safeguard the welfare of communities. So far, SAZ has published standards on air and water quality, waste water, hazardous waste management, environmental management, and motor vehicle exhaust emissions testing methods. SAZ also conducts training on system certification (ISO 14001) and trains systems auditors for ISO 14001 and OHSAS 18001.

c. **The Business Council for Sustainable Development Zimbabwe (BCSDZ)**

BCSDZ holds periodic thematic workshops and annual conferences that draw participants from Industry, Government Departments, NGOs, Local Authorities and experts in various fields.

d. **The Confederation of Zimbabwe Industries** (CZI)

CZI has within its membership, organizations that raise awareness to the general public on the safe handling of hazardous substances by providing well documented labelling on containers.

e. **Consumer Council of Zimbabwe** (CCZ)

CCZ provides representatives on many technical committees in order to ensure that the standards produced are not technical barriers to trade and do not compromise the health and safety of consumers. CCZ plays a pivotal role in awareness campaigns that promote the safety of consumers.

f. **Zimbabwe Environmental Law Association (ZELA)**

ZELA is involved in providing awareness through workshops and seminars to community based groups addressing legal provisions for a safe environment.

g. **CropLife** offers technical advice on the safe use, handling and potential hazards associated with particular agro-chemicals.

h. **Various farming associations and organizations** such as the Cotton Growers Association, Coffee Growers Association, Livestock Producers Association etc publish newsletters targeted for their membership, that are informative on the current and new formulations of agro–chemicals.

i. **The Global Environmental Facility - Small Grants Programme (GEF-SGP)** is one programme that is raising awareness on POPs among communities, in addition to promoting organic farming.

j. **Practical Action Southern Africa** is raising awareness on sound waste management for communities, thus educating the public on reduction of PCDD/PCDF that would have been released through waste burning.

k. **Fambidzanai Training Institute** provides training to rural and urban farming groups on permaculture, organic farming and natural pest and disease management.

l. **Education and Training Institutions**
Chemical safety issues are included in the curriculum of Tertiary and Higher Learning Institutions such as Universities, Agricultural Training Colleges and Polytechnics. All students/ researchers working in Laboratories are given basic knowledge on chemical safety before performing any tests.

m. **Electronic Media – The National Broadcaster (Zimbabwe Broadcasting Corporation)**
The National Broadcaster, to a limited extent, covers aspects of chemical management on both television and radio, by inviting experts to farming programmes such as 'Talking Farming' and 'Murimi Wanhasi/Umlimi Wanamhla'. The experts address matters of national interest involving environmental issues. Other programmes where experts are featured include the radio programmes 'Our Environment' and 'Zvakatikomberedza'. Generally, though, events are reported as they happen.

n. **National Newspapers**
There are a number of daily papers such as the Herald, Chronicle, Daily News, Newsday and weekly papers such as the Sunday Mail and Sunday News, the Financial Gazette and the Independent, which have very wide readership. The Environmental Management Agency (EMA) has a weekly slot in the Herald and the Chronicle, in which they discuss environmental issues. Zimpapers also publishes a weekly paper, The New Farmer, which targets newly resettled farmers and the general public. This weekly publication covers aspects of environmental issues as well agro-chemical management.

Potential of Existing Awareness Raising Structures to Raise POPs Awareness
As can be seen from the aforementioned, there is a lot of potential to raise public awareness on POPs and other chemical issues, from the structures that already exist. All that is required is to strengthen these structures, and also use a coordinated and systematic approach in delivering awareness-raising programmes.

2.1.19.4 Levels of Awareness of POPs Issues

Although there are Government ministries that are mandated with raising awareness on chemicals management, and there are a number of NGOs whose activities contribute to raising awareness on chemicals management, there are no programmes for raising awareness on specific POPs issues. The level of awareness on POPs among the public is therefore very low.

Awareness pertaining to POPs pesticides and general pesticides management is low, as indicated by the way in which users often handle the pesticides. Empty pesticide containers are not treated as hazardous waste, and it is common to find empty plastic pesticide containers having been rinsed out and being used for water storage in the home. Cases of people using unlabelled pesticides are also quite common, with some unlabelled pesticides being sold on the streets illegally. Although some of these pesticides may not be POPs, the fact that the public do not know what to look for when purchasing pesticides means that they could easily become exposed to POPs and other highly hazardous pesticides unknowingly.

The majority of the public have no idea on what PCBs are, and are actually unaware that transformer oil poses any danger to anyone. During the PCB inventory, it was particularly

disconcerting to come across workers who work with transformer oil, who would handle the transformer oil with bare hands, and refuse to use the appropriate PPE because they were "so used to handling the transformer oil", as shown in Figure 6. This showed that workers who handle transformer oil are at a very high risk of exposure to PCBs due to lack of awareness. The high incidence of transformer oil theft implies that there is quite a vibrant market for the product, and this again indicates a lack of awareness on the dangers of PCBs.

Figure 6: A seasoned worker handling transformer oil with bare hands

Awareness on the dangers of Unintentionally-Produced POPs (U-POPs) including PCDD/PCDF is almost non-existent in Zimbabwe, as shown by the rampant way in which people burn waste as a method of managing it. While the public is generally aware of the harmful effects of industrial emissions, they are unaware of the harmful nature of PCDD/PCDF and other U-POPs.

The above-mentioned examples provide evidence of the high levels of unawareness of POPs in Zimbabwe. Lack of awareness is a high-risk factor that can contribute to exposure, since, without knowledge, one cannot take the necessary steps to protect oneself. There is therefore need for concerted efforts to raise the level of public awareness on POPs issues, if the objective of protecting human health and the environment is to be achieved.

2.1.20 Overview of Technical Infrastructure for POPs Assessment, Measurement and Analysis

Zimbabwe has many analytical laboratories (labs) which have the capacity to analyze for pesticides including POPs. There are at least 11 labs which have Gas Chromatographs (GCs) which can be used to analyze for pesticides. These include research labs, Government labs, and university labs. In many cases, the GCs are old and there is need to upgrade. There are currently five laboratories that have Gas Chromatograph-Mass Spectrometers (GC-MS). These instruments are more appropriate especially for analysing unknown substances. The technical infrastructure to analyze for pesticides in the country is thus available – it just needs upgrading.

For PCB analysis, there are machines in Zimbabwe that can analyze oil samples to test for the presence of PCBs. At least three organizations, which include the Ministry of Environment, Water and Climate, as well as the power utility ZETDC, have the capacity to analyze samples for PCBs.

There are no laboratories in Zimbabwe with the capacity to analyze air samples for PCDD/PCDF. The U-POPs Inventory was carried out using the UNEP Toolkit which estimates releases of PCDD/PCDF using developed emission factors.

2.1.20.1 Overview of the Laboratory Equipment in Zimbabwe

An overview of the laboratory equipment in Zimbabwe is given in Table 14:

Table 14: Overview of Equipment Available for Chemicals Analyses in Zimbabwe

Laboratory /Organization	Location	Type of equipment available
Scientific and Industrial Research and Development Centre Laboratories	Harare	Gas Chromatograph – Mass Spectrometer, High Performance Liquid Chromatograph, Atomic Absorption/Emission Spectrometer, Ultra Violet – Visible Spectrometer, Ion Chromatograph, Infrared / Fourier Transform, Viscometer, Inductively Coupled Plasma
Medicines Control Authority of Zimbabwe	Harare	Gas Chromatograph, High Performance Liquid Chromatograph, Atomic Absorption/Emission Spectrometer, Infra Red/Fourier Transform Infra-Red Spectrometer, Climatic Chamber, UV-Visible Spectrometer, Gas Chromatograph – Mass Spectrometer, Karl- Fischer Unit, Polarimeter
Forensic Science Laboratory	Harare	Gas Chromatograph, High Performance Liquid Chromatograph, Fourier Transform Infra Red Spectrometer
Zimlabs	Harare	Atomic Absorption/Emission Spectrometer, Ultra Violet – Visible Spectrometer
Tobacco Research Board Laboratory	Harare	Gas Chromatograph, High Performance Liquid Chromatograph, Atomic Absorption/Emission Spectrometer, Ion Chromatograph, Infra Red Spectrometer, Ultra Violet – Visible Spectrometer, Gas Chromatograph – Mass Spectrometer
Environmental Management Agency Laboratory (EMAL)	Harare	Gas Chromatograph – Mass Spectrometer, Absorption/Emission Spectrometer, Gas Chromatograph, Ion Chromatograph, UV-Visible Spectrometer, Ion Analyzer, Liquid Scintillation Analyzer, Turbidimeter, Tritium Enhancement Cooler
Standards Association of Zimbabwe Laboratories	Harare	Absorption/Emission Spectrometer, Viscometer, Gas Chromatograph, Karl Fischer Unit, UV – Visible Spectrometer, Infra Red Spectrometer, High Performance Liquid Chromatograph
National University of Science and Technology	Bulawayo	Absorption/Emission Spectrometer, Gas Chromatograph, Ion Electrophoresis Analyzer
Department of Research and Specialist Services Laboratory	Harare	Gas Chromatograph, High Performance Liquid Chromatograph, Atomic Absorption/Emission Spectrometer, Ultra Violet – Visible Spectrometer
University of Zimbabwe Laboratories	Harare	Gas Chromatograph, High Performance Liquid Chromatograph, Atomic Absorption/Emission Spectrometer (GF, HG &VG), Ion Chromatograph, Polarographic Analyzer, Infra Red Spectrometer, Ultra Violet – Visible Spectrometer, Gravimetric Thermal Analyzer, X - ray Fluorescence, Ion Chromatograph, Nuclear Magnetic Resonance, Gas Chromatograph – Mass Spectrometer
Midlands State University Laboratories	Gweru	Gas Chromatograph, High Performance Liquid Chromatograph, Atomic Absorption/Emission Spectrometer
Government Analyst Laboratory	Harare	Gas Chromatograph, Atomic Absorption Spectrometer, UV-Vis, FTIR, Gas Chromatograph – Mass Spectrometer
ZETDC Laboratory	Harare	PCB Analyzer, Karlfischer (for analyzing moisture content in transformer oil), Gas Chromatograph
Veterinary Laboratories	Harare	Atomic Absorption Spectrometer, Liquid Chromatograph-Mass Spectrometer

2.1.20.2 Issues of Concern Pertaining to the Running of the Laboratories

The following issues of concern have been identified as hindering the successful running of the laboratories:

i. There is limited financial support for purchasing state of the art equipment. Currently the majority of the laboratories have old and obsolete equipment which needs to be replaced, and as a result, many of them do not perform at optimum level. The government needs to put in place a policy that ensures replacement of equipment when its life span is over.
ii. There is limited funding for purchasing reagents and reference materials, which are necessary for conducting any credible work. There is need to allocate sufficient resources for this.
iii. Staff training and retention need to be prioritized in order to ensure that Zimbabwe will always have the skilled human resources who will be able to operate effectively in its laboratories. Staff turnover is fairly high, hence there is a need to put in place programmes that ensure that members of staff are continuously developed, and the trained staff should be retained.
iv. Most of the laboratories are in Harare, and the rest of the country does not have much in the way of laboratory service. There is need for Government to ensure that there are well-equipped laboratories throughout the rest of the country, so that all areas in the country will have easy access to laboratory services. That will allow for environmental monitoring to be carried out more effectively.
v. Although the country's laboratories are fairly well equipped, there are certain areas of chemical analysis where capacity is lacking, and external laboratories would need to be engaged. Such areas include the analysis of dioxins and furans. However, if the equipment, standards and reference materials are made available, then there will be no need to look to external laboratories.
vi. Most laboratories are not accredited, which makes it difficult for the laboratories to compete on an international scale. Generally, all the laboratories need to be accredited, as is the trend worldwide so that the results from the Zimbabwean laboratories can gain international recognition. Most laboratories indicated they wish to be accredited but are being hampered by a lack of funding to carry out the lengthy process.

2.1.21 Assessing the Impacts of POPs on Human Health and the Environment

A number of studies have been conducted to assess the impacts of POPs on human health in Zimbabwe. These studies have mostly involved assessing the levels of POPs pesticides and industrial POPs in blood, serum and breast milk of selected populations.

a. Impacts of POPs Pesticides on Human Health

The main POPs pesticide, whose impacts on human health have been studied, is DDT. This is because DDT is the one POP pesticide that has been used most widely in Zimbabwe. Other pesticides that have been assessed include lindane and dieldrin, but to a much smaller extent. The studies that have been conducted, and which will be reported on in this NIP, include the assessments of DDT in breast milk from mothers in Harare, mothers in Kariba, and mothers from

selected areas around Zimbabwe. Other studies that will also be reported on include assessment of DDT residues in selected staple foods around Zimbabwe, assessment of human exposure to airborne POPs pesticide pollutants, and assessment of occupational exposure among mosquito control sprayers.

Assessment of DDT in Breast Milk from Mothers in Greater Harare

A study was conducted to assess levels of DDT in breast milk from mothers living in Greater Harare (Chikuni *et al*, 1991). The aim of the study was to assess levels of exposure in women with different social standing. The mothers were classified into two groups according to socio-economic status, educational background, and living conditions. The first group had a relatively high socio-economic status and good dietary habits, as well as a good knowledge of pesticides and their use. The second group had a relatively low socio-economic status, basic educational background, poor dietary habits, and had poor knowledge of pesticides and their use.

These mothers were all healthy, with an average age of 35, and were breastfeeding their first, second or third child. The mothers each provided samples of breast milk that were analyzed for DDT, DDE, PCBs, lindane, heptachlor epoxide and dieldrin. The results showed the levels of DDT to be relatively high, reflecting a continuing use of DDT in agriculture and the effects of the malaria control programme in Zimbabwe (Chikuni & Nhachi, 1996). The levels of DDT were higher in women from the lower income group. The results of this study suggested a possibility of sustained exposure to DDT in Greater Harare, particularly in the lower income group.

The levels of DDT found in the breast milk of mothers in Greater Harare (both high income and low income), were much higher than the tolerable concentration of DDT in human milk, which is 1 mg per kg (Chikuni & Nhachi, 1996). While this should have been a cause for concern, (i.e. the fact that babies were being exposed to DDT at such a delicate developmental stage), the benefits of feeding babies with breast milk were found to far outweigh the consequences of exposure to DDT, hence breast feeding continued to be encouraged.

Assessment of DDT in breast milk of mothers in Kariba area of Zimbabwe

Another study was conducted by Chikuni *et al* (1997) to determine the levels of DDT and its metabolites in the breast milk of mothers living in Kariba (an area where DDT was sprayed for tsetse fly control in the 1980s). In that study, 39 healthy, breast-feeding women who had lived in the area for at least five years were selected to participate in the exercise. Most of the women had been educated up to grade seven only, and their diet consisted of sadza (thick maize meal porridge), fish from the lake, as well as locally grown vegetables. Samples of breast milk were collected from the women and analyzed for DDT and its metabolites.

The results showed the level of DDT in the breast milk samples from Kariba to be very high, as compared to the national mean, or compared to the levels from other African countries. This was attributed to aerial and ground spraying of DDT for tsetse control, which was carried out mostly during the rainy season. The DDT was thus eventually washed out into Lake Kariba, which is the major source of water for the town and the major supplier of fish to the local population. This confirmed that the main route of exposure to DDT is through the diet (Matthiessen, 1984).

Assessment of DDT and its Metabolites in Breast Milk of Women from Selected Areas around Zimbabwe

In another study by Chikuni (2005), breast milk from mothers in various locations throughout Zimbabwe was tested for DDT and its metabolites. The mothers were healthy women aged between 16 and 35 years old, nursing their first, second or third child at the time of sampling (1-12 months post-partum), and had lived in the area for at least five years. A total of 111 mothers participated in the exercise, with each mother providing just one 10 ml sample of milk. The results of the study are shown in Table 15.

Table 15: Mean DDT and Metabolites levels in Mothers' milk around Zimbabwe (in ng/g)

	Nyanga	Mudzi	Kariba	Kadoma	Esigodini	Harare
pp-DDE	5958.9	13784.4	5782.7	1314.4	581.2	1735.2
op-DDD	71.3	23.5	15.2	8.6	18.6	19.2
pp-DDD	52.4	156.9	71.7	2.5	14.5	3.1
op-DDT	846.5	238.1	109.9	17.4	51.5	18.7
pp-DDT	816.1	2636.1	2006.5	33.2	268.4	536.3
Total DDT	7745.2	16838.9	7985.9	1376.0	934.1	2312.9
Ratio ppDDT/DDE	0.14	0.19	0.35	0.03	0.46	0.31

(*Source:* Chikuni, 2005)

The results showed that the highest levels of total DDT were found in breast milk samples from Mudzi, followed by Kariba and Nyanga which had almost similar levels. The high levels of DDT in Mudzi and Kariba were due to the tsetse and malaria control spray operations in the area. The high levels in samples from Nyanga were attributed to the movement of pesticides by the wind (long rang-range transport through wind and water is one of the unique properties of POPs).

Assessment of DDT Residues in Selected Staple Foods around Zimbabwe

It has been noted that the commonest route of exposure to DDT for humans is through food. A study was carried out to determine levels of DDT in some of the more common staple foods in Zimbabwe. Various types of food from six localities in Zimbabwe were tested to determine the levels of DDT in them. The foods included water (from the local river in the area), fresh cow milk, sour cow milk, green leafy vegetables (covo - *Brassica carinata A. Braun)*, cabbage, maize meal, peanut butter and fish (from the local river). The study areas represent different geographical regions in Zimbabwe, with Nyanga being in the Eastern Highlands of Zimbabwe, Mudzi being in the north east, Kariba being along the western border with Zambia, Kadoma being in the central region, Esigodini being in the southern region and Harare being the biggest urban settlement in the country. The results from that study are shown in Table 16.

Table 16: DDT Residues in Selected Stable Foods around Zimbabwe (in ng/g)

Staple Food/Place	Nyanga	Mudzi	Kariba	Kadoma	Esigodini	Harare
Water (local river)	25.6	26.5	32.7	Nd	Nd	5.2
Fresh milk (cow milk)	79.3	75.3	609	42.5	31.5	12.6
Sour milk (cow milk)	77.8	78.9	603	46.2	28.9	11.5
Vegetable (covo)	420.7	695.3	547.3	466.3	9.4	35.6
Vegetable (cabbage)	522.2	591.3	147.8	445.9	20.1	38.5
Maize meal	661.5	874.4	27.4	Nd	6.5	27.4
Peanut butter	297.5	371.6	89.8	Nd	Nd	36.5
Fish (local river)	123.6	103.2	956.0	15.8	Nd	320.0

Key: nd = not detectable. ng/g = nanograms per gram fat.

(*Source: Chikuni, 2005*)

The results showed that DDT residues are present in most foods from different parts of Zimbabwe, though in differing concentrations. The highest concentrations of DDT residues were generally found in foods from Kariba, Mudzi and Nyanga. The high levels of DDT in Kariba and Mudzi were due to the tsetse and malaria control spray operations in the area. The high levels in foods from Nyanga were attributed to the movement of pesticides by the wind (since long rang-range transport through wind and water is one of the unique properties of POPs).

The high levels of DDT residues, especially in cow's milk and fish from Kariba, vegetables from Mudzi, and maize meal from Mudzi and Nyanga were a cause for concern, as they meant that people in the area are exposed to high levels of DDT from their diet. Given that the World Health Organization (WHO) Acceptable Daily Intake (ADI) of DDT is 0.005 mg / kg body weight / day (Duggan & Corneliussen, 1972) (which is 5,000 ng / kg body weight / day), chances are high that much of the populace of these areas often takes in food that contains DDT levels which are higher in total than the Acceptable Daily Limit. There is therefore need for epidemiological studies to monitor the health of people living in these areas, in order to identify any possible health effects arising from their exposure to these high levels of pesticides.

Assessment of Human Exposure to Airborne POPs Pesticide Pollutants

A study was conducted in 1997 – 1998 to determine human exposure to airborne pesticides pollutants (Chikuni & Polder, 2004). The study involved analyzing breast milk of women living in the Mudzi and Nyanga areas of Zimbabwe for traces of the POPs pesticides hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), and DDT and its metabolites. A total of 44 mothers from the two areas participated in the study. The mothers had an average age of 22, and they were all breastfeeding their first or second child. The results from that study are shown in Table 17.

Table 17: Mean levels of POPs pesticides in human milk from Nyanga and Mudzi (ppb, µg/kg fat)

Component	Nyanga	Mudzi
Fat %	3.38	5.10
HCB	3.91	1.75
Sum-HCH	399	277
pp-DDE	6868	13784
Sum-DDT	8810	16839
Ratio DDT/DDE	0.17	0.18

(*Source: Chikuni & Polder, 2004)*

The high levels of HCH found in Nyanga were attributed to the fact that HCH was most likely used as a pesticide in the area, which is a predominant fruit growing area. HCB is a fungicide and a by-product of some industrial processes, and is also found as an impurity in some pesticides. Its higher levels in Nyanga were explained by the fact that some of the pesticides used in the fruit growing industry could have been contaminated with HCB.

The levels of DDT in breast milk of mothers from Mudzi were very high, which was only to be expected as this is an area where DDT was applied for both malaria and tsetse control. The levels of DDT for Nyanga were also very high, despite the fact there is no history of DDT usage in the

area. It was suggested that the reason for the high levels of DDT in Nyanga would be the long-range transport of the POPs pesticides, using the grasshopper effect, from Mudzi to Nyanga (Chikuni & Polder, 2004).

Mudzi, where DDT was sprayed for malaria and tsetse control, is generally a hot area, and the high temperatures would cause some of the DDT to volatilize and be carried by the prevailing south-east trade winds towards the Eastern Highlands. The DDT would then be deposited in the cooler Nyanga area in the Eastern Highlands. The results of this study were significant, in that they showed the need for monitoring of POPs pesticides in all areas (even where the pesticides might never have been used) especially if the areas are downwind and cooler than the areas where the pesticides will have been used.

Assessment of Occupational Exposure among Mosquito Control Sprayers

A study was conducted to determine the exposure of DDT sprayers to DDT (Nhachi *et al*, 1996). In the study, which was conducted over the three-year period 1988 – 1990, 480 spray-men who sprayed DDT in the homes of villagers in malaria-endemic areas, were screened for exposure to DDT. The assessment for DDT exposure was done by measuring blood levels of DDT and its metabolite DDE, and also measuring plasma levels of vitamin A as an index of DDT exposure.

From the results, it was noted that a significant number of spray-men (48.9 %) showed evidence of toxic exposure to DDT, i.e. having plasma DDE levels greater than 1.00 µg/ml and vitamin A levels greater than 0.92 mg/ml. This implied that the measures being taken to protect the spray-men were not adequate, and were allowing the spray-men to get exposed to the DDT.

The spray-men were also assessed for smoking habits. A total of 187 spray-men (39%) were found to be smokers. Further analysis of the results showed a positive correlation between smoking and exposure to DDT. There were two possible explanations for this correlation – either smoking predisposes one to take up DDT into their system, or the smokers would indulge in their habits after spraying without first washing their hands. There might be need to further investigate this correlation between smoking and exposure to DDT.

During the same study, an assessment to determine the spray-men's knowledge of health effects of DDT was carried out. From the assessment, it was noted that only 36% had a complete knowledge of the possible health hazards or effects of spraying DDT, while 53% had partial knowledge (i.e. they had heard about it). The remaining 11% had no knowledge of the health effects of DDT. This implied that the training for the DDT spray-men was inadequate, as it did not seem to cover in depth the reason why the spray-men needed to protect themselves from DDT. If they were unaware of the exact dangers associated with DDT exposure, they might not make the effort to protect themselves appropriately, even if they would have been given the requisite Personal Protective Equipment (PPE). This might explain why there was significant exposure among the spray-men. There is therefore need to improve the training programmes that the spray-men undergo before they embark on the IRS programme.

b. Impacts of Industrial POPs and Unintentionally-Produced POPs on Human Health

Of the originally-listed industrial POPs, studies have been conducted to assess human exposure to PCBs, but these have been part of studies to assess exposure to POPs pesticides. The levels of PCBs were found to be low, where such studies were conducted. Studies which should have been conducted for assessing exposure to PCBs should be conducted on those who work with transformer oil, and are thus likely to be exposed to high levels of PCBs. Such studies have not been conducted, and it would be prudent to carry them out, as this would be surest way to determine whether those who are in close contact with PCBs have been exposed.

Of the new industrial POPs, i.e. brominated flame retardants, and perfluorooctane sulfonic acid (PFOS), no studies have been conducted to determine their impacts on the health of Zimbabweans. Considering the fact that the BFRs are found in so many articles that are used on a day-to-day basis, such as electronic and electrical equipment, furniture items, vehicle interiors etc, and have been detected in breast milk of mothers from North America at elevated levels, it would be necessary to conduct studies to determine impacts of these BFRs on the health of Zimbabweans. This is especially so in view of the current consumption patterns which are resulting in ever-increasing levels of electronic waste in the country.

The impacts of unintentionally-produced POPs such as dioxins and furans on human health in Zimbabwe have not been determined either, as no such studies have ever been carried out. The issue of U-POPs in Zimbabwe is a major one, and the U-POPs inventory which was conducted in 2012 and updated in 2016, revealed that the largest proportion of U-POPs in Zimbabwe is produced as a result of burning of waste. A significant number of people manage their waste in this way, and chances are that they could be exposed to PCDD/PCDF from this practice. It would therefore be necessary to assess levels of dioxins and furans from ordinary members of society, as they are at risk of exposure to these chemicals.

c. Impacts of POPs on the Environment

Following the usage of POPs pesticides for agriculture and for the control of mosquito and tsetse flies, several studies have been conducted since the 1970s, in order to determine the impact of these operations on the environment, particularly on wildlife. These include the studies by Billings & Phelps (1972), Whitwell *et al* (1974), Greichus *et al* (1978), Matthiessen (1985), Phelps *et al* (1986), Phelps *et al* (1989), Mhlanga & Madziva (1990), Kubus & Berg (1991), Douthwaite (1992) and Zaranyika *et al* (1994).

The studies were aimed at identifying the effects of POPs pesticides on the environment, and most of them showed that the POPs were impacting negatively on the environment. The studies on DDT contamination, however, came to different conclusions regarding the source of the DDT, with earlier studies suggesting that the DDT contamination around the Lake Kariba area was due to the influence of agricultural activities (Whitwell *et al*, 1974), while later studies attributed the DDT contamination in the same area to tsetse control (Matthiessen 1984).

Billings & Phelps (1972) conducted a study following the spraying of dieldrin for tsetse control from 1962 to 1967, and the spraying of DDT for tsetse control from 1968 to 1972. The study was conducted by analyzing eggs, embryos, and body fats of crocodiles, and livers of waterbuck, impala, elephant, darter and black flycatcher. The pesticides that were tested for included DDT,

DDE and DDD (two metabolites of DDT), Benzene hexachloride (lindane), dieldrin, aldrin and endosulfan. The study covered Kariba (Sinamwenda area), Mount Darwin (Chesa), Chipinda Pools, Buffalo Range, Nyanyadzi, Victoria Falls and Harare.

Although the study did not find evidence of a heavy build-up of pesticides in the terrestrial environment as a result of the anti-tsetse spraying, it did find evidence of a build-up as a result of agriculture activities (Zaranyika, 2003). The highest levels of organochlorine pesticides were found on agricultural land, while only traces of DDT and its metabolites were found in the eggs of crocodiles and livers of elephants from game reserves where there was no agriculture. This implied that the POPs pesticides residues detected in the study were a result of POPs use in agriculture rather than from tsetse control operations (Zaranyika, 2003). The highest levels of DDT were recorded in bird tissue from Chipinda Pools and Harare. The fact that Harare had some of the highest levels of DDT, yet there have never been any tsetse control operations in the area, again provided evidence that the accumulation of DDT in the test area was a result of agricultural activities, rather than tsetse control operations.

Matthiessen (1984) conducted studies in 1982 – 1983 to investigate the contamination of DDT in the environment around Lake Kariba. The purpose of the study was to measure DDT residues in a wider range of environmental components, to assess the persistence and accumulation of residues in wildlife, and to assess possible biological impacts. The study also aimed to determine the contribution of tsetse control to DDT contamination, as compared to the contribution made by DDT used for mosquito or agricultural control. The study focused mainly on the drainage basin of Lake Kariba and included mostly terrestrial samples, although some samples of sediments, water, mussels (*Mutela dubia*) and fish (*Hydrocynus vittatus*) were analyzed from river mouths entering the lake. From the findings of the study, Matthiessen concluded that:

- Tsetse control operations were the most likely source of DDT contamination in the area, (This conclusion was made based on the fact that DDT use had largely been phased out of commercial farming.)
- DDT did not persist in the physical environment.
- DDT residues (including the metabolites DDD and DDE) accumulate in insectivorous birds and bats at levels which, although not toxic, may affect their reproduction and behaviour and may cause reproductive failure to their avian predators.
- Fish and mussels along the shorelines draining from sprayed areas were significantly contaminated.
- Fish fry in seasonal rivers might also be at risk.
- The levels of contamination in fish were sufficient to explain the contamination and eggshell thinning in the Lake Kariba fish eagles but insufficient, according to internationally recognized standards, to be harmful to human consumers.

Phelps *et al* (1986) conducted similar studies which analyzed crocodile eggs collected from several locations. The eggs were collected from Sengwa River, Mpalangena River, Chundu Island, Kariba Crocodile Farm, Lake Chivero, Ngezi Park, Kyle Park, and Runde River. The eggs analyzed showed residues of DDT and its metabolites, the levels of which were correlated to the land use in the area from which the eggs were collected. Toxaphene was detected in crocodile eggs from cattle ranching areas, while polychlorinated biphenyls were recorded near industrialized areas.

Douthwaite (1992) conducted studies to determine the effects of DDT for tsetse control on white-headed black chat populations in the Zambezi valley in northwest Zimbabwe between 1987 and 1990. The survey was carried out in woodlands that had been sprayed with DDT at the rate of 200 g/ha. In separate studies, populations of the white-headed black chat fell by 88 percent over 33 months, and by 74 percent over 9 months. This proved that spraying of DDT for tsetse control operations had had a severe and prolonged negative impact on the white-headed black chat population of northwest Zimbabwe.

Zaranyika *et al* (1994) carried out studies in which they analyzed sediment samples from seven of the major river bays on Lake Kariba. The results confirmed that there was contamination of most bays by DDT and its metabolites, as well as endosulfan, aldrin, dieldrin, endrin and heptachlor.

Mambanda *et al* (2001) conducted a study of the terrestrial environment in the Mount Darwin - Rushinga area in north eastern Zimbabwe on the border with Mozambique. The purpose of the study was to assess the environmental impact of DDT and its metabolites in relation to previous tsetse fly and mosquito control operations. In the study, analysis was carried out on sediments from rivers and dams, fish, soil, cow dung, grass, and house dust collected along the accessible parts of the Mount Darwin – Rushinga highway near the border with Mozambique. The study was carried out in 1999, 13 years after the last DDT spray in the area (in 1986).

The results of this study showed widespread contamination from DDT residues, despite the fact that the DDT had last been sprayed 13 years previously. All the fish samples contained levels of DDT and its metabolites DDD and DDE, although in some cases, only DDE was found to be present. The presence of DDT and its metabolites in fish, which is a significant protein source for residents in the area, would lead to dietary exposure of humans to the DDT. House dust samples were found to be contaminated with DDT, probably from the IRS and the use of cow dung for maintaining floors in the huts.

Grass and tree leaves were also found to have levels of DDT, although these were fairly low. However, despite the low levels of DDT in these samples, its presence at all is a cause for concern, as the grass and leaves would be eaten by herbivorous animals, and organochlorine pesticides are known to biomagnify on going up the food chain. There is need for monitoring of the meat and milk from areas that were historically sprayed with organochlorine pesticides.

Studies to determine the persistence of endosulfan and lindane in the soil

Studies have also been carried out to determine the persistence of endosulfan and lindane on the soil, following their application to control soya bean and maize pests, respectively. One study conducted by Zaranyika & Mugari (1997), showed the degradation of endosulfan and lindane in soil to be dependent on rainfall. The study showed that when applied at the rate of 600g/ha for endosulfan, and 410 g/ha for lindane, there is a build-up of both pesticides in the agro-ecosystem, due to carry over from the previous season's application. The results reiterated the need to monitor the possible build-up of endosulfan and lindane in soil, as a result of using the pesticides in agriculture.

Impact of Endosulfan on Fish

Endosulfan is known to be highly toxic to fish, and the LC_{50} has been shown to be temperature dependent. In light of the global warming phenomenon, it would be prudent to investigate the effects of climate change on the environmental behaviour of some of these persistent organic pesticides.

Impact of PCBs on the Aquatic Environment

Studies were conducted to determine the levels of PCBs in various media in the aquatic environment (r us et al, 1978). The results indicated that levels of PCB in water were less than 1 ng/ g, levels in dry sediments were 120 ng / g, while levels in fish were 1,200 – 2,300 ng /g. The levels of PCBs increased on going up the trophic level, which was consistent with the biomagnification characteristic of POPs.

d. Recommendations for Assessing Impacts of POPs on Human Health and the Environment

A number of areas of concern and gaps pertaining to studies for assessing the impacts of POPs on human health and the environment have been noted and need to be addressed. The following recommendations are proposed in order to comprehensively understand the impacts of POPs on human health and the environment in Zimbabwe, and thus develop appropriate interventions for protecting human health and the environment from these POPs:

i. Most of the studies were carried out many years ago, and there have not been any studies reported in recent years. Since POPs are persistent, it would be necessary to conduct similar studies in present day Zimbabwe, (when the use of most POPs pesticides has been banned), to monitor trends and see if the levels of POPs pesticides in humans and the environment are changing in any way.
ii. The studies for assessing the impacts of POPs on human health tended to just monitor levels of POPs in breast milk, blood and serum, and it seems they ended there. There were no reported follow-up studies to monitor the health of people who (in their infancy) had been exposed to breast milk containing high levels of POPs pesticides, or the Indoor Residual Spraying (IRS) operators who were found to have high levels of DDT in their system. It is necessary to conduct follow-up studies to determine how the exposed individuals were actually affected.
iii. Studies have been conducted to assess levels of PCBs in various environmental compartments, but it appears there have been no studies to test workers who work with transformers and other PCB-containing equipment on a regular basis, for exposure. It is necessary to assess these workers and screen them for exposure to PCBs.
iv. It has been reported that food from areas where DDT was used for tsetse control, has been found to contain very high levels of DDT. It would be necessary to monitor the health of people in these areas to determine how they have been affected by the DDT.
v. Studies have also shown that areas such as Nyanga, which have no history of DDT usage, but which are cooler than, and are downwind of areas where DDT has been used, have been found to have elevated levels of DDT. It is necessary to extend DDT monitoring to other such areas in Zimbabwe, to assess whether they have also been affected in similar ways, so that the health of the residents in such areas can be monitored.
vi. In the study to test DDT spray-men for exposure to DDT, a positive correlation was found between smoking and DDT exposure. However, it was not clear whether the positive

correlation was caused by the fact that smoking predisposes one to take up DDT into their system, or whether the smokers would indulge their smoking habit before taking off their PPE and washing their hands (which would cause them to take up the DDT). There is need to investigate further the link between smoking and exposure to DDT (and other POPs pesticides).

vii. The study mentioned above, tested the spray-men for exposure to DDT and tested their levels of awareness of the hazardous effects of DDT. The study was conducted from 1988 – 1990 before the use of DDT for IRS was discontinued. DDT usage under the IRS programme was resumed in 2005, but there have been no studies to screen the spray-men under the current programme for exposure. It is necessary to conduct similar studies to determine whether the spray-men under the current programme are being exposed, so that if that is the case (as was before), necessary measures for protecting the spray-men can be implemented.

viii. DDT packaging waste from the IRS programme is currently being sent to a local colliery company for incineration. There is need to conduct tests to determine the efficiency of this facility in destroying the DDT waste, considering that pesticide waste from elsewhere in Africa is currently being shipped to Europe for destruction due to lack of facilities.

ix. Lindane is used as a public health pesticide for the control of head lice and scabies, and in Zimbabwe it is actually sold as an over-the-counter medicine. There is need to investigate the environmental and human health impacts arising from the continued use of lindane, and review the legislation governing its use in Zimbabwe.

x. No studies have been conducted to determine the impacts of the new POPs (Brominated Flame Retardants and Perfluorooctane Sulfonic Acid – PFOS) on human health and the environment. However, with the increase in levels of electrical and electronic equipment in Zimbabwe, there is need to assess for levels of BFRs in the environment and in humans, and determine the effects of these.

xi. There is need to monitor for POPs residues in food for the domestic market, including horticultural and agricultural crops, as well as beef and milk, from areas where POPs have been used in Zimbabwe. While this has mostly been done for DDT, there is need to also consider the other POPs in such studies.

xii. It has been reported that the toxicity of certain pollutants (such as endosulfan) on fish is temperature dependant. Given the fact that Climate Change is so real, it is necessary to assess the effects of this phenomenon on the environmental behaviour of some of these POPs.

xiii. There are several population groups who might have been exposed to POPs at one time or another, and these need to be tested for exposure. They include:

- Populations living in the areas where indoor residual spraying of DDT is carried out;
- Populations living in intensive agricultural areas where POPs pesticides may have been used;
- People who have worked for pesticide companies;
- Informal waste traders, particularly those who handle waste at landfills / waste dumps; and
- The ordinary population, since many people have been exposed to PCDD/PCDF emission through burning. Burning of waste is more rampant and more concentrated in the urban areas; hence the urban population is expected to be more exposed to these emissions than their rural counterparts.

2.1.22 Socio-economic Impacts of POPs

It is known that in addition to having negative environmental impacts, POPs also produce negative socio-economic impacts. Since Governments are endeavouring to implement measures to manage POPs in an environmentally sound manner, it is expected that such interventions will provide positive socio economic impacts for the population. However, there is need to take into account the fact some sectors of society might have been benefiting from the current POPs management practices, and implementing measures for improving the management of POPs could produce negative socio-economic impacts for such sectors of society.

A study of socio-economic impacts of POPs in Zimbabwe was conducted in 2016, in order to assess the negative socio economic impacts of current POPs management practices. The study also assessed the expected positive socio-economic impacts that will arise from interventions for improved POPs management, as well as the expected negative socio-economic impacts that may arise from interventions for improved POPs management.

a. Methodology for conducting the assessment

The study looked at three key facets relating to socio-economic impacts of POPs, and these were:

- The negative socio-economic impacts of current POPs management practices;
- The positive socio-economic impacts of interventions for improved POPs management; and
- The negative socio-economic impacts of interventions for improved POPs management.

For each aspect, the impacts for each of the five groups of POPs (pesticides, PCBs, PFOS, POP-PBDEs and U-POPs) were identified. For the third aspect, mitigation measures to counter the negative impacts were also proposed.

b. Findings from the socio-economic assessment

This section lists the findings from the socio-economic assessment. In most cases, the impacts are general impacts, but where available, empirical evidence for the Zimbabwean situation will be provided.

Negative Impacts from Current POPs Management Practices

A. <u>POPs (and other) Pesticides</u>

i. Exposure for children: Children often work in the fields, and may be exposed to the pesticides, when they are still vulnerable and in their developmental stages.
   <u>Zimbabwe-specific case:</u>
   In Zimbabwe, about 2,126,882 children are known to make up part of the agricultural labour force; hence these children are at high risk of exposure to pesticide, which negatively affects their growth and development.

ii. Loss of agricultural land which will have been contaminated by pesticides:
   <u>Zimbabwe –specific case:</u>
   An example of this is the site which was contaminated by fenitrothion in Mashonaland West more than 12 years ago, which is still lying idle because it is unusable following the contamination (MEWC, 2016).

iii. Sickness caused by exposure due to poor handling of pesticides can lead to increased downtime and subsequent loss of income for the farmers, farm workers and their families);

iv. Potential loss of income for farmers if produce gets rejected due to high pesticide residues;

v. Potential illness caused by chronic exposure from sources such as chlordane that could have been used for termite control in the homes;

vi. The general public could get chronic exposure to pesticides, through ingesting food with pesticide residues;

vii. Availability of the hazardous pesticides could lead to misuse and abuse of the pesticides – suicide, poisoning of children; and

viii. High cost of production of crops due to need for more pesticides (caused by pesticide resistance).

B. Polychlorinated biphenyls (PCBs)

i. Risk of exposure to PCBs for workers who handle PCBs, leading to possible poor health and subsequent loss of income for the family

Zimbabwe-specific case:

In Zimbabwe, the extent of PCB-contamination in electrical transformers is not known, since only preliminary PCB inventories, covering a very small fraction of all transformers, have been conducted. A complete and detailed inventory has not yet been conducted, hence workers who handle transformer oil could be at risk of exposure.

ii. Risk of exposure to PCB for unsuspecting members of the public who may ingest food prepared by PCB-contaminated oil

Zimbabwe-specific example

In Zimbabwe, transformer is often stolen, and one of the uses of this transformer oil is as cooking oil in some unscrupulous food outlets. Ordinary and unsuspecting members of the public are therefore at risk of exposure to PCBs from such sources.

C. Perfluorooctane sulfonic acid and related compounds (PFOS)

ii. Exposure to PFOS for fire-fighters (leading to possible illness and subsequent loss of income to family).

Zimbabwe-specific case

In Zimbabwe, the local authorities use FFF which was imported in the 1970s and 1980s, during which time PFOS was still being added to FFF. Chances of the fire fighters being exposed to PFOS are thus very high.

iii. Exposure (for the public) to PFOS leaching into groundwater from waste dumps and areas where PFOS-containing fire-fighting foam was used for fire-fighting or for training, leading to possible poor health.

D. Persistent Organic Pollutant-Polybrominated diphenyl ethers (POP-PBDEs) in EEE/WEEE

i. Exposure to POP-PBDEs in WEEE for informal waste traders and e-waste recyclers, (leading to possible poor health and subsequent loss of income)

E. Persistent Organic Pollutant-Polybrominated diphenyl ethers (POP-PBDEs) in Transport

i. Exposure to POP-PBDEs in vehicles for ordinary members of the public (may lead to poor health).

Zimbabwe-specific case

In Zimbabwe, people in the middle-income group are likely to be at risk of exposure to these POP-PBDEs from vehicles, since the majority (80%) of Zimbabwe's vehicles were produced before 2005. These vehicles are imported as second hand vehicles, and because they are cheaper than the brand new vehicles, they are mostly purchased by those in the middle-income group, hence this group is at risk of exposure.

F. Unintentionally-Produced POPs

i. Illness caused by exposure from household heating and cooking

Zimbabwe-specific case:

This mostly affects the women, as they are the ones who do the cooking, and often in closed systems. In Zimbabwe, the use of wood fuel for cooking is very common, and wood is used by the majority of people in the rural areas of Zimbabwe where about 65 % of the population live. Only 13% of the rural population has electricity, implying that 87% of the rural population use wood fuel for cooking. The use of wood fuel is also quite common in the urban areas at times, especially when there are power cuts, or when households prefer to use the seemingly 'cheaper' wood for cooking. Zimbabwean women are therefore at high risk of exposure to the PCDD/PCDF and PAHs that are produced from use of wood fuel.

ii. Exposure to PCDD/PCDF from landfill fires for those who live in the vicinity of the landfill / dumpsite (or even for those who live far off, depending on the severity of the fire)

Zimbabwe-specific case

Sporadic landfill fires are a common occurrence in Zimbabwe, with the fires lasting anything from a few hours to several days (or even weeks). Harare's municipal disposal site, Pomona Dump experienced a fire that lasted over a week in November 2016. Satellite images of the smoke plume showed that it travelled up to 140 km from the dumpsite. The number of people who were exposed to the fumes is therefore expected to be very high. While the effects may not be felt immediately, they are cumulative, and will ultimately result in an increased burden of disease for the country.

iii. Exposure to dioxins from waste burning at household level, for the ordinary public

Zimbabwe-specific case

This affects a great percentage of the population, since the majority of people actually believe that burning of waste is a proper method of managing waste. Given such a scenario, it means that many people are at risk of exposure.

iv. Exposure (for the general public) to PCDD/PCDF produced by veldt fires (leading to possible ill health)
Zimbabwe-specific case:
The Zimbabwe public is at high risk of exposure to this, because annually, large tracts of forest and grasslands are burnt by fire during the dry, windy season when chances of dispersion are very high. In 2015 alone, 1,510,343 ha (4 % of Zimbabwe's total land area) was destroyed by wild fires, and a great number of people would have been exposed to these U-POPs.

v. Loss of life and property as a result of veldt fires
Zimbabwe-specific case
In 2014, 12 lives were lost in veldt fires, while 14 lives were lost in 2015. Property worth US$398,688 was also destroyed in 2015 because of wild fires. The 1,510,343 hectares that were destroyed in fire incidences, would have led to loss of income for sectors that get a livelihood from forest resources.

vi. Exposure to PCDD/PCDF emitted from brick production for the informal brick makers and those who live in the vicinity of brick-making establishments which are in the residential areas;

Positive Impacts from Proposed Interventions for Improving the Management of POPs

A. POPs Pesticides
   i. Application of Integrated Pest Management, and subsequent reduction of pesticide usage will lead to healthier families, healthier workers and a healthier population;

   ii. Reduction in usage of pesticides, and utilization of more sustainable crop protection methods can result in the production of more robust, climate-resilient crops (which is necessary in light of the current climate change scenario).

   iii. Reduction in the use of pesticides will reduce the risk of exposure for children, and produce healthier children and ultimately a healthier nation.

B. Polychlorinated biphenyl ethers
   i. Environmentally sound disposal of PCBs will remove PCBs from the system, leading to healthier workers and a healthier population.

C. Perfluorooctane sulfonic acid
   i. Use of PFOS-free fire-fighting foams will lead to healthier fire-fighters, and a healthier population which is not exposed to PFOS in drinking water.

D. POP-Polybrominated diphenyl ethers in EEE/WEEE
   i. Establishment of proper e-waste recycling plants in Zimbabwe will result in economic growth for the country. In addition to just containing the harmful POP-PBDEs, e-waste also contains a wealth of precious minerals, including gold, palladium, silver and

platinum in concentrations which are 40 -50 times higher than in naturally occurring ore. Due to this high value, e-waste recycling is now referred to as 'Urban Mining'. Investing in proper e-waste recycling plants would therefore improve the country's economy, as well as create employment and improve people's livelihoods.

E. POP-Polybrominated diphenyl ethers in Transport

i. Restricting importation of second hand vehicles may result in the resuscitation of car assembly industries in Zimbabwe, leading to job creation and improved livelihoods.

ii. Restricting importation of second hand vehicles will lead to reduction in the amount of foreign currency which leaves the country to purchase the second hand vehicles, and improve the circulation of money within the Zimbabwean economy.

iii. Setting up plants for managing end-of-life vehicles will create employment.

F. Unintentionally-Produced-POPs

i. Promotion of clean energy sources for domestic purposes will result in:
   - healthier women and healthier families;
   - improved livelihoods, as the women will spend less time looking for firewood, and can use that time to conduct income generating activities;
   - higher levels of disposable income for the families, since some of the cleaner energy sources will be cheaper than the firewood.

ii. Promotion of the integrated waste management hierarchy will result in:
   - income generation / employment creation for community based organisations who will embark on waste management projects such as:
     - waste recycling;
     - compost making.
   - healthier families eating food that will have been organically grown in their own back yards (using homemade manure).

iii. Interventions aimed at reducing forest and grassland fires can lead to:
   - increased revenue / profits for timber companies who often make losses due to forest fires;
   - income generation for individuals / SMEs who may clear / cut the grass and produce hay bales for sale.

Negative Impacts from Proposed Interventions for Improving the Management of POPs

A. Polychlorinated biphenyls

i. Testing in-service transformers for PCB contamination, and subsequently draining PCB-contaminated oil will result in electricity outages, which may affect production in industry / on farms and lead to economic losses.

Mitigation:
The power utility should ensure that all affected parties are informed well before the proposed shutdown, so that they prepare. The power utility can also ensure that such shutdowns are conducted when the electricity demand from industry and the agricultural sector is at its lowest.

B. Polybrominated diphenyl ether`s in Transport

i. Restricting importation of second hand vehicles will result in the majority of middle-income families failing to own cars, as the brand new cars that will be produced at local car-assembly plants will be too expensive for the middle-income families.
Mitigation:
- *The public transport system can be revamped to make it more efficient.*
- *Sources of finance can be sought to be used as seed money in a revolving fund to allow middle-income families to get loans and purchase brand new vehicles.*

Recommendations from the Socio-Economic Assessment

i. Socio-economic benefits of implementing interventions for improved POPs management

The socio-economic assessment served to confirm the immense social and economic benefits that can arise from improved POPs management. The current POPs management practices result in many negative impacts, mostly in the form of health conditions arising from chronic exposure. Poor health will ultimately lead to an increased burden of disease for the country, which requires more resources for the health sector to be able to cope. Improving the management of POPs in Zimbabwe will lead to reduced exposure, reduced burden of disease, which will leave more resources available for other development projects.

The implementation of interventions for reducing releases of POPs in to the environment will also lead to positive macro and micro-economic benefits for the country. A number of the interventions, such as sustainable waste management projects (production of organic fertilizers, or the e-waste recycling to recover precious metals), result in employment creation and value addition, thus contributing to the achievement of Zim Asset objectives. It is therefore recommended that all the proposed interventions for improving POPs management in Zimbabwe be implemented, in order for the country to realise all the associated economic and social benefits.

ii. Need for detailed socio-economic assessment

The socio-economic assessment that was conducted was preliminary, and gave a general idea of the negative social and economic impacts that arise from poor POPs management practices, as well as the positive social and economic impacts that can be obtained from improved POPs management. However, there is need to conduct a detailed socio economic assessment, which will quantify in monetary terms, the cost of continuing with unsustainable POPs management practices, as well as the benefit of implementing environmentally sound POPs management options. This will give substantiation to the critical need for improving the management of POPs in particular and the environment in general.

CHAPTER 3. STRATEGIES AND ELEMENTS OF ACTION PLANS OF THE NIP

3.1 Policy Statement

Zimbabwe has signed and ratified the Stockholm Convention on Persistent Organic Pollutants. As a Party to the Convention, it has to meet several obligations under the Convention, all aimed at reducing and ultimately eliminating the usage and / or production of POPs. The ratification of the Convention by the Government shows its high level of commitment towards contributing to the creation of POPs-free world.

The preparation of the NIP and its subsequent update further demonstrates the Government's commitment to ensuring sound management of POPs in Zimbabwe. The NIP will serve as a roadmap for the best strategy to follow in effectively addressing issues of POPs, since it identifies the key POPs issues which need to be addressed, and also comes up with specific action plans for addressing the key issues through consultative stakeholder driven processes.

3.2 NIP Update Process

The process of updating the NIP involved conducting POPs inventories and baseline assessments (infrastructure assessment, socio-economic assessment, and health and environmental impact assessment). From the inventories and baseline assessments, issues of concern were identified and prioritized. Since objectives and action plans had been developed in the initial NIP, these were reviewed and re-crafted under the NIP update process, in order to take into account the newly identified issues. All these processes were conducted by stakeholders and experts in issues of POPs.

3.3 Implementation of the NIP

The NIP will be implemented by various stakeholders, but most of the projects will be coordinated by the Ministry of Environment, Water and Climate, with guidance from the POPs National Coordinating Committee (NCC). The projects that are to be implemented as part of the NIP will require funding, which is to be sought from both national and international donors. There are, however, a number of action plans that have direct economic benefit to the country, so financiers, rather than donors, can be approached to bankroll such economically viable projects.

Although many of the projects will require funding, it has been noted that there are several quick wins that can be obtained without large amounts of donor-funding. These are the issues that simply need the human resources that are already available to make input, in order for improvements in the management of POPs to be realized in a short time. It is proposed that the NCC identifies such quick wins, so that relevant activities can be implemented immediately. Alternatively, a NIP Implementation Team can be set up to identify such quick wins, and start implementing relevant activities. It is envisaged that implementation will begin in June 2017.

The specific action plans in the NIP describe what the country needs to do in order to reduce and eventually eliminate the production and / or use of POPs. A number of the activities in the action plans are also included in other national policies / plans / strategies (which are not

necessarily designed for chemicals management) or are already being implemented under other programmes. The fact that a number of the activities that are required in order to reduce the production and / or use of POPs are already catered for in other national programmes, serves as an assurance that activities which will result in POPs reduction can commence, even before funds for the specific NIP implementation process are secured. Again, the fact that a number of these national programmes are already underway and are being sponsored by Government, highlights the high level of contribution that the Government of Zimbabwe is making towards ensuring the reduction of POPs.

Monitoring and Evaluation (M and E) of the NIP implementation will be undertaken in order to determine the level of achievement of the set objectives and measure the impact of the activities. M and E will be carried out by MEWC, the NCC and the donors.

3.4 Prioritized POPs Issues, Goals and Objectives

The review of priorities and objectives, and development of specific action plans (mentioned in Section 3.2) were carried out at a workshop involving key stakeholders. At the workshop, findings from the inventories and baseline assessments (infrastructure assessment, assessment of POPs impacts on human health and the environment, and socio-economic assessment) were presented, as well as the key issues of concern that had been identified from the inventories and assessments. Participants also added key issues of concern which they considered to have been left out.

The identified issues of concern were ranked using two criteria, namely

- the severity of the human health and environmental impacts if no intervention was put in place; and
- the ease of implementing interventions.

From that ranking process, the issues of concern were prioritised as follows:

1. The continued usage of POPs;
2. The need for awareness raising on chemicals management issues;
3. The need to review and develop appropriate legislation and policies for chemicals management (legislation / policies to include implementation of GHS at a national level; domestication of MEA and OSH conventions; legislation to include development of environmental model by-laws by local authorities);
4. The need to improve coordination of chemicals management issues, (including initially establishing a chemicals task force; and setting up a chemicals management forum);
5. The need to strengthen capacity for chemicals data management;
6. The need to establish proper storage facilities for chemicals and chemical wastes;
7. The need to conduct research and monitoring to assess the impacts of POPs on human health and the environment, so as to be able to establish clear epidemiological links (include effects of human exposure to DDT, lindane, POPs; monitoring of POPs in food for the domestic market; conducting emissions quality monitoring at Hwange DDT waste incineration);
8. The need to build capacity for chemicals emergency preparedness;
9. The need to equip laboratories with reagents and relevant equipment;
10. The need to clean up contaminated land and dispose of obsolete chemicals;

11. The need to improve the management of chemical waste, including recycling and recovery;
12. The need for regulatory and non-regulatory incentives; and
13. The need to establish a chemicals management board / entity.

The list above gives the priorities that were identified as needing to be addressed in order to ensure the improved management of POPs in Zimbabwe. Goals and objectives for addressing these priorities were then set. The crafting of the goals and objectives took into cognisance the fact that the NIP is meant to serve as a guiding document of measures required to implement the Stockholm Convention and address all POPs. The goals and objectives were therefore not confined to the priority areas, but covered all areas that need to be addressed in order to improve the management of POPs. The list of priorities is, however, critical in that it identifies those areas that need to be addressed with the most urgency, but the goals and objectives are meant to ensure the coverage of all issues that need to be addressed by the Stockholm Convention. The goals and objectives are as listed below:

Goal 1: To reduce the intentional production and use of POPs within five years (Article 3 of SC)

Objectives pertaining to POP-PBDEs

Objective 1: To reduce releases of POP-PBDEs through ESM of EEE and WEEE within three years

Objective 2: To reduce releases of POP-PBDEs from the transport sector within three years

Objectives pertaining to PFOS and related chemicals

Objective 1: To reduce releases of PFOS and related chemicals into the environment within five years

Objectives pertaining to new POPs pesticides

Objective 1: To eliminate the use of endosulfan by 2018

Objective 2: To promote the use of alternatives to lindane for public health purposes within three years

Objective 3: To promote the use of safer alternatives for all other new POPs pesticides and other Highly Hazardous Pesticides within three years

Objectives pertaining to DDT

Objective 1: To promote the use of alternatives to DDT within three years

Objective 2: To improve the management of DDT in Zimbabwe, focussing on management of waste from the DDT that is used for the IRS within two years

Objective 3: To notify the Stockholm Convention Secretariat of the need for a specific exemption for continued DDT usage within six months

Objectives pertaining to PCBs

Objective 1: To reduce releases of PCBs through environmentally sound management of PCB-contaminated oils and equipment within five years

Goal 2: To reduce emissions of unintentionally produced POPs from major sources within five years (Article 5 of SC)

Objective 1: To improve solid waste management in the country within three years, including the incorporation of the integrated waste management hierarchy

Objective 2: To improve the management of hazardous waste within five years, including the incorporation of integrated waste management hierarchy and the improvement of hazardous waste disposal sites

Objective 3: To reduce the hectarage burnt by veldt fires by 10% annually over three years

Objective 4: To reduce emissions of dioxins and furans from fossil fuel burning by 5% annually over three years

Objective 5: To promote BAT / BEP in all industrial processes producing high levels of dioxins and furans, including biomass power plants within three years

Goal 3: To strengthen the regulatory and policy framework for environmentally sound management of POPs within five years (Article 3 of the SC)

Objective 1: To review and develop appropriate legislation and policies for POPs management within three years

Objective 2: To strengthen enforcement of existing legislation to reduce illegal trafficking of banned chemicals and sales of counterfeit pesticides / chemicals within two years

Objective 3: To promote the use of regulatory and non-regulatory incentives for POPs management within two years

Goal 4: To strengthen institutional framework for managing POPs and other chemicals within five years

Objective 1: To improve coordination and implementation of chemicals management issues, including through the establishment of a chemicals task force and a chemicals management forum within five years

Objective 2: To enhance the capacity of the National Chemicals Emergency Preparedness Plan within five years

Goal 5: To reduce releases of POPs from stockpiles and wastes through environmentally sound management of contaminated land and obsolete chemicals within five years (Article 6)

Objective 1: To manage contaminated sites in Zimbabwe in an environmentally sound manner, including cleaning up such sites within five years

Objective 2: To conduct environmentally sound management of obsolete chemicals in Zimbabwe, including disposal within five years

Objective 3: To provide appropriate storage facilities for chemicals and chemical wastes awaiting destruction within two years

Goal 6: To raise awareness on the sound management of POPs and other chemicals and hazardous wastes within three years (Article 10)

Objective 1: To raise national awareness on POPs and their management within three years for the different stakeholder groups, focusing on safe use of chemicals, and the promotion of safer alternatives

Goal 7: To improve research and monitoring of POPs impacts on human health and the environment within five years (Article 11)

Objective 1: To commence monitoring of key environmental media, in targeted areas, for POPs and other relevant hazardous chemicals within one year

Objective 2: To establish chemical surveillance for monitoring POPs (human health and the environment) within six months

Objective 3: To assess the effects of POPs and other chemicals on human health and the environment within five years

Objective 4: To build capacities of at least 25% of national laboratories to conduct relevant analysis for evidence based decision making within five years

Objective 5: To develop a good science – policy interface by which policy will advise the research sector on areas requiring research, and the research sector conducts research on these and informs policy, within one year

Objective 6: To strengthen capacity for chemicals and wastes data management within three years

3.5 Specific Action Plans

The goals and objectives mentioned above are meant to address Zimbabwe's issues of concern, at the same time implementing the requirements of the Stockholm Convention. This section provides justification for each goal that was crafted, and also describes the requirements of the Convention which are being addressed by the goal and / or objectives. The detailed specific action plans, showing objective, activities, responsibilities, time frame and proposed budget, are shown in Table 18.

Goal 1: To reduce the intentional production and use of POPs within five years (Article 3 of SC)

This goal addresses the measures that will be taken to reduce the use of Annex A and B chemicals, thus addressing the requirements of Article 3 of the Stockholm Convention (described in Box 3). Annex A and B chemicals include the pesticides and industrial chemicals. During the inventories and baseline assessments, it was noted that the newly listed industrial POPs (PFOS and POP-PBDEs) are present in significant quantities in articles which are currently in use in Zimbabwe, such as EEE, vehicles and fire-fighting foams. This puts people at risk of exposure when they use these articles, hence there is a need to manage them in an environmentally sound manner, so as to reduce exposure.

The new POPs pesticides have been banned for use in Zimbabwe, but a lot of endosulfan is still being used. Lindane has been banned for agriculture, but it is still allowed for use as a pharmaceutical in the control of scabies and head lice. PCBs are still in use in transformers, and there is need to replace the PCB-contaminated oil with clean mineral oil, and dispose of the contaminated oil. DDT is still used for IRS in the control of malaria, although the Convention requires parties to make efforts to seek alternatives to its use (see Box 4).

All this intentional use of POPs needs to be reduced, and eventually eliminated. The objectives that have been set in order to achieve the goal, are therefore aimed at phasing out the use of these POPs (and replacing them with suitable alternatives), as well as managing wastes and

contaminated sites containing or contaminated with these POPs in an environmentally sound manner.

A socio-economic study of POPs and POPs management options noted that managing e-waste (the source of POP-PBDEs) in an environmentally sound manner would not only protect human health and the environment from the POPs, but would reap economic benefits for the country. Therefore, the implementation of certain objectives listed under this goal would be highly beneficial to the country from an economic perspective, and should be pursued.

Box 3: Summary of Article 3 of the Stockholm Convention

Article 3- Measures to reduce or eliminate releases from intentional production and use

The Article requires parties to take measures to

- eliminate its production, use, import and export of Annex A chemicals
- restrict its production and use of Annex B chemicals
- ensure that chemicals listed in Annex A or Annex B are imported ONLY for the purpose of environmentally sound disposal or for uses which are permitted for the particular party under Annex A or B
- ensure that chemicals for which specific exemptions exist in the country are exported only for the purpose of environmentally sound disposal, and to a country
- ensure that chemicals listed in Annex A for which exemptions are no longer in effect for any party, are not exported unless it is for the purpose of environmentally sound disposal
- regulate with the aim of preventing the production and use of new pesticides or new industrial chemicals which exhibit the characteristics of persistent organic pollutant
- Take into consideration the criteria for POPs characterization listed in Annex D of the Convention, when conducting assessments of pesticides or industrial chemicals currently in use.
- ensure that for any exemptions listed for the party, production or use is carried out in a manner that prevents or minimizes human exposure and release into the environment

Box 4: Summary of Annex B, Part II of the Convention

Each Party using DDT is encouraged to develop and implement an action plan as part of its NIP. That action plan shall include

- Development of regulatory and other mechanisms to ensure that DDT use is restricted to disease vector control;
- Implementation of suitable alternative products, methods and strategies, including resistance management strategies to ensure the continuing effectiveness of these alternatives;
- Measures to strengthen health care and to reduce the incidence of the disease.

Goal 2: To reduce emissions of unintentionally produced POPs from major sources within five years (Article 5 of SC)

This goal describes the measures that will be taken to reduce emissions from unintentional production, in particular the dioxins and furans (resulting also in a similar reduction of other U-POPs). Zimbabwe has a number of processes that give rise to U-POPs emissions, but the inventory showed that the biggest sources of dioxins are open burning processes (waste burning and forest fires), followed by heat and power generation, incineration, and landfilling. The objectives described are therefore aimed at improving the management of these processes, sin order to reduce the U-POPs produced by the processes. Addressing U-POPs is a requirement in Article 5 (described in Box 5).

Box 5: Summary of Article 5 of the Convention

Article 5 - Measures to reduce or eliminate releases from unintentional production

Parties are required to take the following measures to reduce the total releases derived from anthropogenic sources of Annex C chemicals, with the goal of ultimately eliminating them:

a. Develop and implement an action plan designed to identify, characterize and address the release of the chemicals listed in Annex C and to facilitate implementation of subparagraphs (b) to (e). The action plan shall include the following elements:
   - An evaluation of current and projected releases, including the development and maintenance of source inventories and release estimates,
   - An evaluation of the efficacy of the laws and policies of the Party relating to the management of such releases;
   - Strategies to meet the obligations of this paragraph;
   - Steps to promote education and training with regard to, and awareness of, those strategies;
   - A review every five years of those strategies and of their success in meeting the obligations of this paragraph; such reviews shall be included in reports submitted pursuant to Article 15;
   - A schedule for implementation of the action plan, including for the strategies and measures identified therein;

b. Promote the application of available, feasible and practical measures that can expeditiously achieve a realistic and meaningful level of release reduction or source elimination;

c. Promote the development and require the use of substitute or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C, taking into consideration the general guidance on prevention and release reduction measures in Annex C;

d. Promote and require the use of best available techniques for new sources within source categories which a Party has identified as warranting such action in its action plan. When applying best available techniques and best environmental practices, Parties should take into consideration the general guidance on prevention and release reduction measures in that Annex;

e. Promote, in accordance with its action plan, the use of best available techniques and best environmental practices (using relevant guidance documents):
   - For existing sources, within the source categories listed in Part II of Annex C and within source categories such as those in Part III of that Annex; and
   - For new sources, within source categories such as those listed in Part III of Annex C which a Party has not addressed under subparagraph (d).

Goal 3: To strengthen the regulatory and policy framework for environmentally sound management of POPs within five years (Article 3 of the SC)

The current regulatory framework for environmental management is very sound regarding general environmental management, and is quite comprehensive in addressing issues pertaining to the management of hazardous chemicals in general, but is rather silent when it comes to management of specific POPs such as U-POPs, PCBs, PFOS and POP-PBDEs. Again, many of the requirements of the chemicals and wastes MEAs have also not been enshrined into local legislation. There is need to review the legislative framework in order to include the management of specific POPs, as well as to domesticate the provisions of chemicals and wastes MEAs.

The current legislation which addresses the management of chemicals in general is not being fully enforced, resulting in activities such as sale of illegal pesticides being rampant. There is thus need to also improve the enforcement of existing legislation so that releases of hazardous chemicals into the environment can be reduced in the interim. This goal is therefore meant to address those needs relating to an improved regulatory framework for the management of chemicals and wastes.

Goal 4: To strengthen institutional framework for managing POPs and other chemicals within five years (Article 3)

During the infrastructure assessment, it was noted that there are a number of gaps pertaining to the administrative and institutional infrastructure for POPs management. These need to be improved in order to ensure that measures for reducing the use and / or production of POPs can be implemented effectively and efficiently. The goal and its ensuing objectives therefore aim to improve these fundamental frameworks to allow for the sound management of POPs.

Goal 5: To reduce releases of POPs from stockpiles and wastes through environmentally sound management of obsolete chemicals and contaminated land within five years (Article 6)

The inventories identified stockpiles of POPs pesticides (endosulfan, lindane and dieldrin), other obsolete pesticides, and industrial chemicals (POP-PBDEs, PFOS, and PCBs) in Zimbabwe. These stockpiles need to be disposed of in an environmentally sound manner, in order to protect humans and the environment from exposure.

In addition to the existence of obsolete chemicals stockpiles, it is also known that there are a number of contaminated sites in Zimbabwe. These include areas contaminated with pesticides and other chemicals arising from spillages; waste dumpsites; areas where hazardous chemicals such as PCBs are stored; and areas where hazardous chemicals have been used (such as timber treatment sites). Although these areas are known to exist, detailed inventories of the areas have not been conducted, and so there is no information on their exact locations, the identification of the exact contaminants (in the case of waste dumpsites), the extent of contamination, or the impacts of the contamination on the ecosystem. In the majority of cases, there has not been much in the way of efforts to clean up the contaminated sites.

The goal therefore describes the measures that will be taken to ensure the environmentally sound disposal of obsolete chemical stockpiles, as well as measures that will be taken to identify and clean up contaminated sites. These are in line with the requirements of Article 6 of the Stockholm Convention (described in Box 6)

Box 6: Summary of Article 6 of the Convention

Article 6 - Measures to reduce or eliminate releases from stockpiles and wastes

Parties are required to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a chemical listed in Annex A, B or C, are managed in such a manner as to protect human health and the environment through:

- Developing appropriate strategies for identifying:
  - Stockpiles consisting of or containing chemicals listed either in Annex A or Annex B; and
  - Products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C;
- Identifying stockpiles consisting of or containing Annex A and B chemicals;
- Managing stockpiles in a safe, efficient and environmentally sound manner.
- Taking appropriate measures to ensure that such wastes are:
  - Handled, collected, transported and stored in an environmentally sound manner;
  - Disposed of in such a way as to destroy or irreversibly transform the persistent organic pollutant content so that they do not exhibit the characteristics of POPs or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation is not the most environmentally sound option;
  - Not be disposed of in a way that can lead to recovery, recycling, reclamation, direct reuse or alternative uses of POPs; and
  - Not transported across international boundaries without taking into account relevant international rules, standards and guidelines;
- Developing appropriate strategies for identifying sites contaminated by Annex A, B or C chemicals and undertake any remediation of those sites in an environmentally sound manner.

Goal 6: To raise awareness on the sound management of POPs and other chemicals and hazardous wastes within three years (Article 10)

It has long been realized that one of the major reasons for the poor management of POPs in Zimbabwe is lack of awareness among the general public, on how to sustainably manage the POPs – how to handle and use them without exposing themselves and the environment to harm. Raising awareness on what POPs are, the dangers they (and other hazardous chemicals) pose, as well as how they should be managed, is a fundamental aspect that should be dealt with if any of the other inventions are to be successful. This goal therefore ensures that requisite methods for raising awareness are employed, which directly addresses the requirements of Article 10 of the Convention, described in Box 7.

Box 7: Summary of Article 10 of the Stockholm Convention on Public Information, Awareness and Education

Article 10 - Public information, awareness and education

Parties are required to promote and facilitate:

- Awareness among its policy and decision makers with regard to POPs;
- Provision to the public of all available information on POPs;
- Development and implementation, especially for women, children and the least educated, of educational and public awareness programmes on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives;
- Public participation in addressing persistent organic pollutants and their health and environmental effects and in developing adequate responses;
- Training of workers, scientists, educators and technical and managerial personnel;
- Development and exchange of educational and public awareness materials at the national and international levels; and
- Development and implementation of education and training programmes at the national and international levels.

Parties are also required to:

- ensure that the public has access to public information on POPs and that the information is kept up-to-date;
- encourage industry and professional users to promote and facilitate the provision of information on POPs at the national level and, as appropriate, sub-regional, regional and global levels;
- consider developing mechanisms, such as pollutant release and transfer registers, for the collection and dissemination of information on estimates of the annual quantities of the chemicals listed in Annex A, B or C that are released or disposed of.

In providing information on POPs and their alternatives, Parties may use safety data sheets, reports, mass media and other means of communication, and may establish information centres at national and regional levels.

Goal 7: To improve research and monitoring of POPs impacts on human health and the environment within five years (Article 11)

This goal, and the ensuing objectives, describes the measures that need to be taken to promote and undertake research and monitoring of POPs in Zimbabwe. Interventions for improving the management of POPs require financial resources, and it is easier to seek such financial resources if there is empirical evidence showing how the national population and the environment are being affected by the current POPs management practices.

Promoting and conducting research is therefore imperative in order to identify cause-effect relationships between chemical exposure, and subsequent ill health. The Stockholm Convention also emphasizes the need to conduct research and monitoring, as stated in Article 11 (shown in Box 8)

Box 8: Summary of Article 11 of the Stockholm Convention on Research, Development and Monitoring

Article 11 - Research, development and monitoring

Parties are required to encourage and/or undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants and, where relevant, to their alternatives and to candidate persistent organic pollutants, including on their:

- Sources and releases into the environment;
- Presence, levels and trends in humans and the environment;
- Environmental transport, fate and transformation;
- Effects on human health and the environment;
- Socio-economic and cultural impacts;
- Release reduction and/or elimination; and
- Harmonized methodologies for making inventories of generating sources and analytical techniques for the measurement of releases.

Parties are further required to, within their capabilities:

- Support and further develop, international programmes, networks and organizations aimed at defining, conducting, assessing and financing research, data collection and monitoring, taking into account the need to minimize duplication of effort;
- Support efforts to strengthen national scientific and technical research capabilities, particularly in developing countries and countries with economies in transition, and to promote access to, and the exchange of, data and analyses;
- Undertake research work geared towards alleviating the effects of persistent organic pollutants on reproductive health;
- Make the results of their research, development and monitoring activities referred to in this paragraph accessible to the public on a timely and regular basis; and
- Encourage and/or undertake cooperation with regard to storage and maintenance of information generated from research, development and monitoring.

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Table 18: Specific Action Plans in Detail

Goal 1: To reduce the intentional production and use of POPs within five years (Article 3 of SC)

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
POP-PBDEs							
Objective 1: To reduce releases of POP-PBDEs through ESM of EEE and WEEE within three years							
a. Gazette SI on e-waste management.	Conduct necessary processes to ensure gazetting of SI on e-waste management	SI gazetted	EMA	MEWC, AG's Office	12 months	10,000	The SI has been drafted, and is undergoing stakeholder consultation. The process has been funded by Government.
b. Develop and finalise e-waste policy.	• Get stakeholders contributions to the draft policy through workshops. • Input stakeholders' comments on the draft policy and finalise. • Launch policy.	E-waste policy in place	MICTPCS	MEWC, EMA	2 years	60,000	The first draft of the policy has already been developed in a process which is being funded by Government.
c. Set standards for EEE to be imported / used in Zimbabwe. Specific tasks include	• Convene meetings between MEWC and SAZ to initiate the process. • Set up technical committee for developing standards. • Formulate the standards.	Standards in place	MEWC, SAZ	MIC, EMA, MICTPCS, SAZ	2 years	80,000	The Government has set up a Standards Development Fund, which is used for the development of standards, so the cost will be borne by Government.
d. Set standards for disposal of WEEE:	• Convene meetings between MEWC and SAZ to initiate the process. • Set up technical committee for developing standards. • Formulate the standards.	Standards in place	MEWC	MIC, EMA, MICTPCS, SAZ	2 years	80,000	Government will bear that cost through the use of the Standards Development Fund.
e. Promote extended producer responsibility. Specific actions will include	• Identify possible EPR options / instruments that can be applied. • Engage industry and other players to discuss options.	Document describing the EPR mechanism to be implemented	MEWC	EMA, MIC, MICTPCS	12 months	10,000	Zimbabwe has produced a National Integrated Solid Waste Management Plan which looks at issues such as EPR

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
	• Implement selected instruments, including raising awareness among stakeholders.	M&E reports describing uptake of EPR					
f. Engage electronic distributors and end users, in order to promote sound management of EEE/ WEEE.	• Conduct meetings and workshops	Reports of meetings	MEWC	EMA, MIC, MICTPCS, Retailers Association of Zimbabwe	12 months	40,000	
g. Conduct pre-shipment inspection of EEE through including EEE on the consignment based conformity assessment programme (CBCA).	• Conduct assessment to identify exact specifications of EEE to be included on the CBCA. (Process will include stakeholder consultations). • Conduct dialogue with MIC to agree on modalities of inclusion of EEE items. • Conduct paperwork to facilitate inclusion of the EEE items onto the programme. • Ensure inclusion of EEE items onto the SI. (*This needs to be done simultaneously with the process of including second hand vehicles on the CBCA programme / institute in order to reduce the frequency of revising the SI)*	SI / documentation showing inclusion of EEE on CBCA programme	MEWC / MIC	EMA, MJLPA	12 months	10,000	The CBCA programme is already operational in Zimbabwe (funded by Government), and the process will require liaison between MEWC and MIC to ensure inclusion of the items onto the SI which lists the products which are subject to the process.
h. Establish e-waste recycling	• Set up e-waste recycling organizations.	At least one organisation	EMA	MEWC, MIC, MFED,	12 months	400,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
organisations		established		MLGPWNH			
i. Set up e-waste recycling plant.	• Identify financiers for the projects. • Set up modern e-waste recycling plant, that adheres to international best practices.	Modern e-waste recycling plant set up	MEWC	EMA, MFED, MLGPWNH, financiers	5 years	4,000,000	
j. Conduct awareness campaigns on e-waste management.	• Conduct a baseline assessment to determine awareness levels and management practices. • Develop an awareness-raising programme on e-waste management. • Implement awareness raising programme. • Conduct monitoring and evaluation to determine effectiveness of the programme.	Baseline report on e-waste management practices and awareness Document detailing e-waste awareness programme to be carried out Reports on number and types of awareness campaigns conducted Monitoring and evaluation reports on effectiveness	EMA	MEWC, MICTPCS, MIC, Retailers Association of Zimbabwe	3 years	100,000	
k. Conduct and regularly update inventories, (serving as substance flow analysis) of	• Establish e-waste inventory teams involving more players, and conduct inventory training. • Develop e-waste inventory plan for the Zimbabwe (detailing scope, extent and	Inventory plan in place Inventory reports Database in	MEWC	EMA, MICTPCS, ZIMSTAT, MIC	3 years	60,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
POP-PBDEs in e-waste.	frequency of inventories). • Conduct e-waste inventories and manage the data in a database.	place					
l. Establish e-waste collection centres	• Set up at least 10 e-waste collection centres at strategic locations throughout the country	At least 10 e-waste collection centres set up throughout the country	EMA	MEWC, MICTPCS, MLGPWNH	2 years	300,000	
Total						**5,150,000**	
Objective 2: To reduce releases of POP-PBDEs from the transport sector within three years							
a. Restrict and control the importation of vehicles produced before 2005 through formulation and enforcement of regulations (using a pre-shipment inspection programme).	• Identify specifications of vehicles to be included on the CBCA. (Process may include stakeholder consultations) • Conduct dialogue with MIC and MTID to agree on modalities of inclusion of vehicles. • Conduct paperwork to facilitate inclusion of the vehicles onto the programme. • Ensure inclusion of vehicles onto the SI. (*This needs to be done simultaneously with the process of including EEE on the CBCA programme / institute in order to reduce the frequency of revising the SI)*	SI on pre-shipment inspection (CBCA) programme for vehicles	MEWC, MIC	EMA, MTID	2 years	10,000	The need to restrict importation of second hand vehicles for economic and environmental reasons has been raised in the past by policy makers, and some measures towards the process, such as increased duty on second hand vehicles, have already been effected.
b. Explore other options of restricting the importation of second-hand	Conduct dialogues with relevant stakeholders to identify other options for restricting importation.	Minutes of meetings Reduction in numbers of	MEWC	MFED, MTID, EMA	1 year	10,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
vehicles.	Implement appropriate options.	imported pre-2005 vehicles					
c. Establish the quantities of waste to be generated from the current and deregistered fleet.	Conduct detailed inventory looking at: • total number of registered vehicles as well as types (cars, buses, trucks) • Total annual imports • region of import and year of manufacture • number of vehicles which are currently in use, and the ones which are no longer in use. (The POP-PBDEs inventory quantified the total imports and estimated the number of the different types. It did not differentiate between the vehicles which are still in use, and those which are no longer in use). Identification of deregistered vehicles will require field work.	Inventory report detailing the quantities of waste to be generated from current and deregistered fleet Database in place	MEWC	EMA, MTID, ZIMSTAT	9 months	20,000	
d. Set up facility for recycling, recovery and disposal of ELV.	Facility should be set up in accordance with specifications outlined in UNEP Guidance document on BAT/BT of POP-PBDEs.	ELV Treatment facility in place	MEWC	EMA, MTID, MFED, financiers	3 years	1,000,000	
e. Raise awareness on environmentally sound management of ELV.	• Develop an awareness raising programme on e-waste management. • Implement awareness raising programme. • Conduct monitoring and evaluation to determine effectiveness of the	Document outlining awareness programme Report on awareness activities	EMA, MTID	MEWC	3 years	60,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
	programme.	conducted					
Total						**1,100,000**	
PERFLUOROOCTANE SULFONIC ACID AND RELATED CHEMICALS (PFOS)							
Objective 1: To reduce releases of PFOS into the environment within five years							
a. Conduct and regularly update, detailed inventory of all PFOS-containing fire-fighting foams and aviation hydraulic fluids in local authorities, airports & mines (All users of PFOS containing substances should provide regular returns on the amounts purchased, amounts used and amounts in stock).	• Set up and train an inventory team. • Develop a PFOS inventory plan (looking at scope, extent, and frequency of data collection). • Conduct a workshop for fire fighters to build capacity on PFOS inventory data collection, and the need to submit the data timeously. • Collect inventory data from fire fighting organizations based on the agreed frequency. • Conduct monitoring visit to fire fighting organizations to assess inventory process.	Regularly updated database of fire-fighting foams and aviation hydraulic fluids	MEWC	MLGPWNH, MMMD, MTID, Chamber of Mines, CAAZ	12 months	10,000	
b. Conduct study on the feasibility of switching to alternative non-PFOS-containing fire-	Carry out study on alternatives and do cost-benefit analysis.	Detailed report on alternatives to PFOS, including cost--benefit analysis of the different alternatives	MEWC, SIRDC	MHTESTD, Academia, MLGPWNH, MMMD, MTID,	12 months	25,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
fighting foams and aviation hydraulic fluid .							
c. Stop the import of PFOS foams and develop plan for the gradual phasing out of PFOS-containing fire-fighting foams, and aviation hydraulic oil, including reducing current stockpiles.	• Develop the PFOS phase-out plan. • Raise awareness among all users of fire-fighting foams on the harmful effects of PFOS, in order to discourage any more imports of PFOS-containing fire-fighting foam.	Detailed plan for gradual phase-out of PFOS-containing substances	MEWC	MLGPWNH, MMMD, MTID, Chamber of Mines, CAAZ	3 months	5,000	
d. Implement PFOS phase-out plan.	• Conduct awareness campaigns on the harmful effects of PFOS-containing fire-fighting foam. • Advocate for a ban on PFOS-containing fire fighting foam through legislative amendment (the ban will have a grace period). • Purchase PFOS-free fire-fighting foam to replace the stocks of PFOS-containing fire-fighting foam. • Dispose of the current stocks of PFOS-containing fire-fighting foams in an environmentally friendly manner.	Reduction in quantities of PFOS used and in stock (information to be verified from database)	MEWC	MLGPWNH, MMMD, MTID, Chamber of Mines, CAAZ	5 years	800,000	
Total						**840,000**	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
NEW POPs PESTICIDES							
Objective 1: To eliminate the use of endosulfan by December 2018							
a. Enforce ban at ports of entry to stop illegal imports (to include training)	• Conduct training for personnel at ports of entry. • Ensure enforcement of ban.	Reports for training of Customs officials No endosulfan coming into the country	MAMID (DR&SS)	MEWC, ZIMRA	6 months	15,000	
b. Build capacity in Agritex to raise awareness among farmers on endosulfan ban, and on appropriate alternatives.	• Develop awareness raising materials. • Conduct specific training sessions for Agritex.	Training reports All Agritex officers conversant with the endosulfan ban, and the appropriate alternatives Zero usage of endosulfan	MAMID	MEWC	6 months	15,000	
c. Raise awareness on ban of endosulfan among relevant target groups, at the same time promoting safer alternatives.	• Identify target groups. • Develop awareness raising programme highlighting reasons for endosulfan ban, and available alternatives. • Prepare awareness materials. • Conduct awareness campaigns.	Number of awareness materials produced and disseminated No of awareness campaigns conducted	MAMID	MEWC	6 months	25,000	MAMID is already raising awareness on the ban by informing pesticide dealers, who have since stopped importing it and are now promoting alternatives. This strategy is quite successful, judging by reduced usage of endosulfan, but the awareness raising needs to be intensified in order to reach more stakeholders.
Total						**55,000**	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
Objective 2: To promote the use of alternatives to lindane for public health purposes within three years							
a. Conduct study on the extent of lindane usage for public health purposes.	Conduct desk study, with visits to MCAZ, pharmaceutical companies, MHCC.	Report produced	MEWC,	MHCC	6 months	5,000	
b. Identify alternatives to lindane and document need for use of alternatives.	• Identify alternatives. • Produce report to document alternatives and support and justify use of alternatives.	Document describing alternatives to lindane, and justifying phase out	MEWC, MHCC		6 months	5,000	Some alternatives (such as benzyl benzoate) are already on the local market, which eases the process of identifying alternatives.
c. Engage Ministry of Health in dialogue to promote usage of alternatives, and phase out lindane.	Conduct meetings at various levels to promote phase out.	Minutes of meetings with MHCC Replacement of lindane by alternatives	MEWC	MHCC,	12 months	5,000	
Total						**15,000**	
Objective 3: To promote the use of safer alternatives for all POPs pesticides (new and original POPs) and other Highly Hazardous Pesticides (HHPs) within three years							
a. Identify other pesticides for which alternatives need to be promoted.	• Identify other pesticides such as Highly Hazardous Pesticides (HHPs).	List of HHPs for which alternatives need to be promoted	MAMID	MEWC, MHCC	3 months		
b. Identify and evaluate alternative chemicals and technologies.		Alternatives identified for the more popular POPs	MEWC, MAMID	EMA, MHCC	12 months	25,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
c. Build Capacity on use of alternative technologies such as IPM (to include awareness campaigns on harmful effects of POPs as well as advantages of alternatives.	• Develop awareness programme for safe alternatives and IPM (campaigns should also focus on harmful effects of POPs and HHPs). • Conduct awareness programme. • Conduct demonstration projects on IPM.	Number of awareness materials and campaigns Reduced use of HHPs Increase in uptake of IPM (number of case studies to be recorded by Agritex)	MAMID, MEWC	EMA, MHCC, FAO	3 months	100,000	Government, through the Plant Protection Unit in MAMID, is already conducting programmes aimed at promoting IPM, such as demonstration projects and farmer field schools using IPM in managing fruit flies. However, the programmes are not widespread due to limited resources. CropLife also encourages its members (pesticide distributors) to promote IPM, and currently, five of the biggest agrochemicals suppliers in Zimbabwe promote the application of IPM among their customers.
d. Conduct M&E	Conduct monitoring and evaluation to assess uptake of safer alternatives and IPM.	M&E report	MEWC	EMA, MAMID MHCC	3 years	12,000	
Total						**137,000**	
DDT							
Objective 1: To promote the use of alternatives to DDT within three years							
a. Participate fully in the regional project to demonstrate alternatives to DDT	• Develop national plan for executing project activities locally. • Implement national plan	National Plan in place Quarterly reports indicating progress in	MHCC	MEWC, MAMID, EMA	3 years	640,000	The project commenced in December 2016, and Zimbabwe is participating fully, with the Government supporting personnel who are working on the project.

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
		implementation of the project					
b. Apply lessons learnt in the regional DDT project to the Zimbabwean situation.	• Prepare a document highlighting lessons leant, how they relate to the Zimbabwean context, and how they can be integrated into the Zimbabwean context. • Integrate identified lessons into the Zimbabwean situation.	Document outlining lessons learnt Reduction in amount of DDT used in Zimbabwe, leading to total elimination	MHCC	MEWC, MAMID, EMA	3 years	200,000	
Total						**840,000**	
Objective 2: To improve the management of DDT in Zimbabwe, focusing on management of waste from the DDT that is used for IRS, within two years							
a. Assess effectiveness of current DDT waste management practices through testing of emissions at Hwange Colliery (Furans & Dioxins).	• Prepare sound sampling protocol for collecting samples to analyse for dioxins and furans. • Collect samples (air, water and soil) from the vicinity of Hwange Colliery, according to the agreed sampling protocol. • Send the samples for analysis at suitable laboratories.	Lab analysis results for tests conducted before, during and after incineration of DDT waste	MEWC	EMA, MHCC	12 months	200,000	
b. Manage the DDT waste in an environmentally sound manner.	• Use the results obtained in activity 'a' above to determine course of action for managing DDT waste, using internationally accepted standards, and develop action plan (which could focus on including the DDT waste on the obsolete pesticides	Reports outlining interventions conducted	MHCC	MEWC, EMA	12 months	50,000	

Activity	Tasks	Success Indicators	Lead Responsibility	Supporting organisations	Time Frame	Budget	Comments on the Implementation Status (where applicable)
	inventory, and ensuring the environmentally sound disposal of the obsolete pesticides waste). • Implement the action plan.						
Total						**250,000**	
Objective 3: To notify the Stockholm Convention Secretariat of the need for a specific exemption for continued DDT usage within three months							
Notify Stockholm Convention Secretariat of the need for a specific exemption for continued DDT usage.	Prepare and submit relevant paperwork to Stockholm Convention Secretariat.	SC website showing Zimbabwe listed on the register of specific exemptions for DDT	MEWC	MHCC	3 months	--	
Polychlorinated Biphenyls (PCBs)							
Objective 1: To reduce releases of PCBs through environmentally sound management of PCB-contaminated oils and equipment within five years							
a. Participate fully in the regional project to dispose of PCBs	• Develop national plan for implementing project activities in Zimbabwe. • Implement plan. • Ensure the disposal of PCB-contaminated oil and capacitors.	National plan for implementing project activities in Zimbabwe Number of tonnes of PCB-contaminated oil and PCB-capacitors disposed of	MEWC	ZESA, MEPD, EMA, MHCC, MMMD, Chamber of Mines, NSSA	5 years	650,000	The project commenced in October 2016, and Zimbabwe is participating fully, with the Government supporting personnel who are working on the project.
Total						**650,000**	

Goal 2: To reduce emissions of U-POPs from major sources within five years (Article 5 of the SC)

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
Objective 1: To improve solid waste management in the country within three years, including incorporation of the integrated waste management hierarchy							
a. Conduct awareness raising on integrated solid waste management.	• Develop a programme for raising awareness among the different stakeholder groups, on sound waste management. • Implement awareness-raising programme. • Monitor and evaluate the effectiveness of the programme, using the information in the National Integrated Waste Management Plan as baseline information.	Awareness raising materials developed Informed stakeholder Improvement in management of waste	MEWC	EMA, MLGPWNH, Local authorities, MHCC, All Ministries	3 years	150,000	Government is already implementing the National Integrated Waste Management Plan (which focuses on promoting recycling, among other things), and the activity to conduct awareness on integrated solid waste management will be integrated with this process.
b. Construct compliant landfills in all local authorities.	• Develop standards for landfills, and cost the landfills. • Identify suitable financing mechanisms, including exploring the issue of PPPs. • Mobilise resources for the construction of the landfills. • Construct the landfills.	Standards for landfills developed Compliant landfills in place	MLGPWNH	MEWC, EMA, Local authorities, Zimbabwe Local Government Associations, SAZ	5 years	10,000,000	A number of local authorities have embarked on the process of constructing properly engineered landfills, and are at different stages. Some have identified the land, at least one has embarked on the construction (using donor funds), while at least one plans to self-finance the construction of its landfill.
c. Promote adoption of BAT / BEP in organic waste management.	• Develop situation-specific guidelines for applying BAT / BEP to organic waste management. • Apply BAT /BEP in	Situation-specific guidelines for applying BAT / BEP to organic waste management in place	MEWC, EMA	MLGPWNH, MEPD, ZERA, EMA, MHCC, SIRDC,	5 years	1,500,000	The production of organic fertilizers is one of the deliverables in the economic blueprint Zim Asset, hence the concept already has the

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
	organic waste management, drawing from the guidelines.	BAT/ BEP implemented in organic waste management, with supporting reports in place		Academia			support of Government.
d. Facilitate formation of partnerships between local authorities in Zimbabwe with other International local authorities in order to access resources.	• Identify suitable international local authorities with which to form partnerships • Undertake the necessary paperwork and other facilitation steps to establish the partnerships	Partnerships established	MLGPWNH	MFED, MEWC, MEPD, EMA, ZERA	5 years	20,000	
Total						**11,670,000**	
Objective 2: To improve the management of hazardous waste within five years, including the incorporation of integrated waste management hierarchy and the improvement of hazardous waste disposal sites							
a. Conduct stakeholders' awareness for the local authorities and other generators of hazardous waste.	• Develop awareness materials. • Conduct awareness raising workshops.	Awareness materials in place Reports of workshops . meetings with different stakeholders	EMA,	MEWC, MLGPWNH,	12 months	50,000	Awareness raising is already being conducted by EMA as part of their mandate.
b. Continue with annual service level benchmarking (SLB) exercise.	• Set up SLB teams. • Conduct SLB. • (There may be need to conduct SLB on selected sample local authorities,	SLB reports	MLGPWNH	MEWC, EMA	12 months	600,000	SLB has been conducted before in the country, and hence capacity has already been built. There is need for resources to

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
	followed by monitoring, in order to reduce costs.)						continue with the exercise regularly.
c. Construct compliant landfills in all local authorities.	• Develop standards for landfills, and cost the landfills. • Identify suitable financing mechanisms, including exploring the issue of PPPs. • Mobilise resources for the construction of the landfills. • Construct the landfills.	Standards for landfills developed Compliant landfills	MLGPWNH	MEWC, EMA, Local authorities, Zimbabwe Local Government Associations, SAZ	5 years	10,000,000	
d. Install new compliant incinerators in all hospitals and clinics operating incinerators	• Prioritize hospitals and clinics which should receive new incinerators, based on agreed criteria. • Mobilize resources for installing the incinerators. • Install the incinerators.	Report detailing the prioritized hospitals and clinics, with a clear description of prioritization criteria Installed compliant incinerators	MLGPWNH, MHCC	MEWC EMA SAZ SIRDC	5 years	3,000,000	
e. Install nine new incinerators for burning animal carcasses (veterinary purposes)	• Mobilize resources for installing incinerators in other provinces. • Install the incinerators.	Installed incinerators	MAMID	MHCC, MEWC, MLGPWNH	5 years	630,000	
Total						**14,350,000**	
Objective 3: To reduce the hectarage burnt by veldt fires by 10% annually over three years							
a. Strengthen the coordination on veldt fire prevention, awareness campaigns, mitigation and	This strengthening should be done through a collaborative effort for implementing the National Fire Strategy and annual Fire Action Plans.	Number of awareness campaigns conducted Number of fire management	MEWC, EMA	MRDPPNCH, MAMID, MLGPWNH, Forestry Commission, Department of Civil Protection,	3 years	150,000	Government is implementing the National Fire Strategy and Implementation Plan, as well as annual Fire Action Plans, and the objective will be

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
response teams,		measures implemented Reduction in hectarage burnt		MTID, MLRR			integrated with this process. A real-time fire monitoring system is in place and is being implemented by EMA. The system uses GIS technology.
Total						**150,000**	
Objective 4: To reduce emissions of dioxins and furans from fossil fuel burning by 5% annually over three years							
a. Review the legal framework to include POPs. The process should be done simultaneously with the legislative review process mentioned in Goal 3.		Legal framework in place	MEWC	MJLPA, MEPD, ZERA, EMA, SAZ, MLGPWNH	3 years	20,000	
b. Promote / adopt BAT / BEP in order to reduce emissions.	• Develop situation-specific guidelines for applying BAT / BEP to fossil- fuel burning. • Apply BAT /BEP in fossil fuel burning, drawing from the guidelines.	Situation-specific guidelines on BAT /BEP \ Reports indicating BAT/BEP measures taken up by different organizations	MEWC	MIC, MEPD, ZERA, EMA, MLGPWNH	5 years	300,000	
Total						**320,000**	
Objective 5: To promote BAT / BET in all industrial processes producing high levels of dioxins and furans, including biomass power plants within three years							
a. Translate and adapt guidelines for BAT/BEP requirements	• Adapt BAT / BEP guidelines to the Zimbabwean context. • Translate as necessary...	Guidelines translated and adapted	MEWC	MIC, MEPD, EMA, MLGPWNH	9 months	10,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
for the Zimbabwean industries.							
b. Identify and implement mechanisms for promoting the adoption of BAT/BEP.	• Select the most suitable measures based on cost and appropriateness. • Mobilize resources for implementing the measures. • Implement the measures.	Baseline showing application of BAT/BEP Increase in uptake of BAT/BEP (shown by reports indicating BAT/BEP measures taken up by different organizations)	MEWC	MIC, MEPD, EMA, MLGPWNH	3 years	100,000	
Total						**110,000**	

Goal 3: To strengthen the regulatory and policy framework for environmentally sound management of POPs within five years (Article 3)

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
Objective 1: To review and develop appropriate legislation and policies for POPs management within three years, taking into account gaps mentioned in section 2.2 of this NIP							
a. Review existing Acts	Review Acts to identify gaps regarding POPs and chemicals MEAs	Legislation review report Legislation amended	MEWC	EMA, MJLPA, MAMID, MHCC, MPSLSW, MLGPWNH	3 years	150,000	
b. Draft regulations to include POPs, domestication of chemicals MEAs.	Draft regulations as necessary.	Reviewed / new regulations	MEWC	EMA, MJLPA, MAMID, MHCC, MPSLSW, MLGPWNH, MICTPCS	3 years	100,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
c. Develop policy for POPs management.		Policy in place	MEWC	EMA, MJLPA, MAMID, MHCC, MPSLSW, MLGPWNH, MICTPCS	12 months	80,000	
d. Develop environmental management model by-laws.	The model by laws will be developed by local authorities in conjunction with relevant stakeholders).	Model by law	MEWC	MJLPA MLGPWNH	12 months	10,000	
Total						**340,000**	
Objective 2: To strengthen enforcement of existing legislation to reduce illegal trafficking of banned chemicals and sales of counterfeit pesticides / chemicals within two years							
a. Conduct baseline assessment to quantify the amounts of illegal chemicals / pesticides being sold in Zimbabwe.	The baseline assessments can be done during the routine inspections that are undertaken by EMA, MHCC, MAMID).	Report on the quantities of illegal chemicals / pesticides being sold	MEWC, EMA, MAMID, MHCC	ZRP, ZIMRA	6 months	10,000	EMA, MHCC and MAMID conduct inspections in the chemical retail sector (as part of their mandate), hence such assessments can be undertaken during the inspection process.
b. Conduct training for enforcement agents.	• Develop training materials. • Conduct training workshops.	Training workshop reports	MEWC, EMA, MAMID, MHCC	ZRP, ZIMRA	6 months	30,000	
c. Enhance enforcement of existing legislation.	• Work with well trained enforcement agents. • Conduct increased patrols and blitzes.	Reduction in the quantities of illegal chemicals sold	MEWC, EMA, MAMID, MHCC	ZRP, ZIMRA	12 months	40,000	
Total						**80,000**	
Objective 3: To promote the use of regulatory and non-regulatory incentives for POPs management within two years							
a. Develop / identify incentives for	Development of incentives will be done by the MEWC in consultation with the key	Document / report detailing the incentives	MEWC	MAMID, MHCC , MFED, ZIMRA, MIC, BCSDZ,	12 months	25,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
improved POPs management.	stakeholders. Incentives should include monetary and non-monetary ones.	developed / identified		NSSA, CZI, CropLife,			
b. Provide incentives for improved POPs management		At least 4 incentives provided	MEWC	MAMID, MHCC , MIC, BCSDZ, NSSA, CZI, CropLife,	12 months	15,000	
Total						**40,000**	

Goal 4: To strengthen institutional framework for managing POPs and other chemicals within five years

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
Objective 1: To improve coordination and implementation of chemicals management issues, including through the establishment of a chemicals task force and a chemicals management forum within five years							
a. Establish and operationalize a task force (interim entity that will eventually be strengthened to become a legal entity)	• Develop concept paper, with proposed operational modalities (structure and ToRs). • Conduct dialogue with key players at the highest level to agree on operational modalities. • Set up task force.	Concept paper Minutes of meetings to discuss modalities Task force in place	MEWC	MAMID (DR&SS), MHCC (GAL, Environmental Health, NMCP), NSSA, EMA, CropLife Ministry of Defence	1 year	80,000	
b. Establish and operationalize a chemicals body/entity.	• Develop legal instrument (Act) for establishing Chemicals Management Body. • Set up and operationalize Chemicals Management Body by providing requisite resources.	Supporting Act of Parliament enacted Chemicals Management body set up and functional	MEWC	MAMID (DR&SS), MHCC (Environmental Health, GAL, NMCP), NSSA, EMA, CropLife Ministry of Defence	4 years	300,000	
Set up a chemicals	• Identify potential participants for the	ToRs of chemicals management forum	MEWC	MAMID (DR&SS), MHCC	12 months	5,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
management forum (forum to be spearheaded by MEWC, and provide a platform to discuss general / topical chemicals management issues).	stakeholder forum. • Draft ToRs for the stakeholder forum. • Advertise / inform potential participants. • Conduct initial meeting, where ToRs are adopted, and potential discussion topics proposed. • Conduct regular meetings.	Database of stakeholders Minutes of first meeting		(Environmental Health, GAL, NMCP), NSSA, EMA, CropLife Ministry of Defence			
Total						**385,000**	
Objective 2: To enhance the capacity of the National Chemicals Emergency Preparedness Plan within five years							
a. Employ experts in chemicals management activities.	Employ suitable number of chemicals experts.	Number of adequate experts employed Number of adequate experts hired	EMA	MEWC,	6 months	5,000	
b. Register chemicals emergency preparedness companies	• Set and document minimum standards for chemicals emergency preparedness companies. • Register chemicals emergency preparedness companies.	Number of companies registered Quicker and more effective clean ups	EMA	MEWC	6 months	5,000	
c. Acquire chemical emergency equipment	• Identify the specifications for the equipment required. • Purchase the necessary equipment.	Chemicals emergency preparedness equipment hired Improved handling of chemicals emergencies	EMA	MEWC	2 years	970,000	The Government has acquired some equipment, especially PPE, but there is need for more PPE. There is also need to acquire equipment for managing and cleaning up chemical contamination.

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
d. Improve coordination with other stakeholders involved in chemicals emergency management.	• Develop programme for building capacity in chemicals emergency preparedness among other key stakeholders (police, hospitals, local authorities). • Prepare training materials. • Conduct training workshops. • Conduct monitoring and evaluation to assess effectiveness of capacity building.	Training conducted for other stakeholders Improved handling of chemicals emergencies by all concerned (to be shown from indicators such as • quicker reaction times • reduced loss of lives • quicker and more effective clean-up activities	EMA	MEWC, MHCC , Department of Civil Protection, ZRP, Industry, NSSA, Local authorities (fire departments), MTID	6 months	20,000	
Total						**1,000,000**	

Goal 5: To reduce releases of POPs from stockpiles and wastes through environmentally sound management of contaminated land and obsolete chemicals within five years (Article 6)

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
Objective 1: To manage contaminated sites in Zimbabwe in an environmentally sound manner, including cleaning up / remediating such sites within five years							
a. Carry out a comprehensive inventory of all chemical-contaminated sites (and not only those contaminated by POPs).	• Conduct training for contaminated sites inventory. • Conduct inventory of contaminated sites. • Input data into database.	Reports on inventory training workshops Inventory reports Database of contaminated sites	MEWC	EMA, MAMID, NSSA, MHCC, CropLife, FAO, BCSDZ, MIC	9 months	80,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
b. Identify and cost clean-up options.		Report detailing the requirements and costs for cleaning up each contaminated site	MEWC	EMA, MAMID, NSSA, MHCC, CropLife, FAO, BCSDZ, MIC	6 months	10,000	
c. Prioritize sites to be cleaned up.	• Come up with prioritization criteria (including cost, effectiveness and any other selected criteria). • Prepare prioritized list of contaminated sites to be cleaned up.	Prioritized lists of sites to be cleaned up	MEWC	EMA, MAMID, NSSA, MHCC, CropLife, FAO, BCSDZ, MIC	3 months	2,000	
d. Engage companies and organisations with capacity to conduct clean up.		Procurement documents Contracts with companies for cleaning up	MEWC	EMA, MAMID, NSSA, MHCC, CropLife, FAO, BCSDZ, MIC	6 months	10,000	
e. Clean up the contaminated sites		Cleaned up sites – reports available	MEWC	EMA, MAMID, NSSA, MHCC, CropLife, FAO, BCSDZ, MIC	24 months	5,000,000	
Total						**5,102,000**	
Objective 2: To conduct environmentally sound management of obsolete chemicals (including pesticides, PCBs and other industrial chemicals) in Zimbabwe, including disposal within five years							
a. Strengthen inventories of obsolete chemicals in Zimbabwe (to include inventories of obsolete	• Conduct refresher training courses for inventories PCBs and obsolete pesticides • Update inventories of PCB, and obsolete pesticides	Training reports Inventory reports	MEWC	EMA, MAMID, MHCC. ZESA, MIC, BCSDZ, FAO	6 months	150,000	Training of trainers programmes have been conducted for PCBs and Obsolete pesticides inventory teams, hence national capacity for conducting these inventories already

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
pesticides, PCBs. in both closed and open systems).							exists. Only refresher courses will be required.
b. Implement the FAO Pesticide Stock Management System database (PSMS) for keeping records of all pesticides produced, in use, in stockpiles and disposed.	• Conduct training for implementing PSMS. • Acquire necessary up-to-date computers. • Capture obsolete pesticides data into the PSMS.	PSMS training report in place PSMS database in place and functional	MEWC, MAMID	FAO, EMA, MHCC, CropLife	6 months	40,000	
c. Strengthen regulatory and policy framework in order to prevent further accumulation of obsolete chemicals.	• Develop interim guidelines for preventing further accumulation of obsolete pesticides stocks. • Develop policy for preventing further accumulation. • Review legislation to include mechanisms for preventing further accumulation of obsolete pesticides.	Policy / Guidelines in place detailing the measures to be taken to prevent further accumulation	MEWC	EMA, MAMID, MHCC. ZESA, MIC, BCSDZ	6 months	30,000	
d. Develop disposal plans for environmentally safe disposal of obsolete chemicals, drawing from the results of the obsolete	Develop disposal plans which should include • Costing • prioritization for disposal based on cost • identification of required paperwork	Disposal plan in place	MEWC	EMA, MAMID, MHCC. ZESA, MIC, BCSDZ	3 months	5,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
chemicals inventories.							
e. Develop and implement an empty pesticide container management system.	• Identify stakeholders. • Discuss and agree on best container management strategy. • Raise awareness on the strategy • Implement strategy	Reports indicating that empty container management system in place and operational	MEWC, MAMID	EMA, CropLife, MHCC	12 months	100,000	
f. Set up temporary storage structures for obsolete chemicals.	• Mobilize resources for the process. • Identify suitable land in each province and purchase. • Prepare construction plans. • Construct temporary storage structures. •	Temporary storage structures in each province	MEWC	EMA, MAMID, MHCC. ZESA, MIC, BCSDZ	12 months	1,800,000	
g. Dispose of the obsolete chemicals in an environmentally sound manner.	• Mobilize resources for the process. • Identify suitable disposal facility and prepare the necessary paperwork. • Conduct safeguarding of original stores. • Repackage as necessary and transfer to temporary structure. • Process shipment and transit permits. Ship off for proper disposal.	Quantities of chemicals disposed of recorded	MEWC	EMA, MAMID, MHCC. ZESA, MIC, BCSDZ	21 months	2,000,000	
Total						**4,125,000**	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on the Implementation Status (where applicable)
Objective 3: To provide appropriate storage facilities for chemicals and chemical wastes within four years							
a. Identify required storage infrastructure.		Document detailing the required infrastructure	MEWC	MLGPWNH, Local authorities, EMA, MHCC	12 months	1,000	
b. Develop building plans.		Approved plans	MEWC	MLGPWNH, Local authorities, EMA	1 month	12,000	
c. Engage construction company		Procurement reports Contract with construction company in place	MEWC	MLGPWNH, Local authorities, EMA, SAZ	6 months	1,000	
d. Construct storage facilities		Storage facilities completed	MEWC	MLGPWNH, Local authorities, EMA, SAZ	12 months	1,800,000	
e. Transfer of chemicals to storage facilities		Chemicals / chemical wastes stored in completed facilities	MEWC	MLGPWNH, Local authorities, EMA, SAZ	ongoing	500,000	
f. M&E		M & E reports in place	MEWC	MLGPWNH, Local authorities, EMA, SAZ		5,000	
Total						**2,319,000**	

Goal 6: To raise awareness on the sound management of POPs and other chemicals and hazardous wastes within three years (Article 10)

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
Objective 1: To raise national awareness on POPs and their management within three years, focusing on safe use of chemicals, environmentally sound management of hazardous chemicals and wastes, negative effects of hazardous chemicals and wastes, and promotion of safer alternatives							
a. Develop awareness raising programme / communication strategy		Awareness programme in place	MEWC, EMA,	MAMID, MHCC MPSLSW, MLGPWNH, MMIBS	4 months	10,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
b. Identify stakeholders		Database of stakeholders	MEWC, EMA	MAMID, MHCC MPSLSW, MLGPWNH, MMIBS	2 months		
c. Conduct inception meeting with stakeholders		Minutes of meeting	MEWC, EMA		3 months	10,000	
d. Conduct meetings of committees		Minutes of meetings	MEWC, EMA	MAMID, MHCC MPSLSW, MLGPWNH, MMIBS	3 years	2,000	
e. Develop and disseminate POPs awareness materials		Different types of awareness materials in place	MEWC, EMA	MMIBS, MPSE MHTESTD	3 years	150,000	
f. Conduct awareness raising activities.	Activities should include: • Capacity building for journalists • high level breakfast briefing meetings • Capacity building and training for extension workers and traditional leaders • POPs based competitions for school children for eco-schools and other schools • Parliamentarians workshop focusing on POPs	Minutes / reports of meeting	MEWC, EMA	MMIBS OPC, CZI, BCSDZ MAMID MRDPPNCH MLRR EMA MPSE, MLGPWNH, MYIEE, MHTESTD Zimbabwe Youth Council, NGOs OPC Parliament MLGPWNH	12 months 3 years 6 months 3 years 6 months	20,000 10,000 15,000 20,000 10,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
g. Conduct monitoring and evaluation to assess effectiveness of awareness raising programme		Monitoring and evaluation report	MEWC, EMA		6 months	15,000	
h. Integrate Green chemistry and Sustainable Chemistry in secondary school and tertiary education curricula	Conduct necessary groundwork required to integrate new concepts into curricula. Integrate concepts into curricula.	Modules developed and integrated in curricula	MEWC	EMA, MPSE, MHTESTD, MIC, BCSDZ	3 years	150,000	
Total						**412,000**	

Goal 7: To improve research and monitoring of POPs impacts on human health and the environment within five years (Article 11)

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
Objective 1: To commence monitoring of key environmental media, in targeted areas, for POPs and other relevant hazardous chemicals within one year							
a. Conduct baseline assessments (benchmarking) of POPs and relevant hazardous chemicals in various environmental media		Test results / reports	MEWC, Academic and Research Institutions,	EMA, MAMID, MHCC and all other testing labs	6 months	100,000	
b. Conduct ambient air monitoring for dioxins and furans.		Test results /reports	MEWC, Academic and Research Institutions	EMA, MAMID, MHCC and all other testing labs	Ongoing	100,000	
c. Conduct monitoring of water and land (soil) in targeted areas for		Test results / reports	MEWC, Academic and Research Institutions,	EMA, MAMID, MHCC and all other testing labs	Ongoing	100,000	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
contamination by POPs and other relevant hazardous chemicals							
Total						**300,000**	
Objective 2: To establish chemical surveillance for monitoring POPs (Human health and the environment) within six months							
a. Formulate and prioritize indicators.		Set of prioritised indicators	MEWC, MHCC	NSSA	3 months	5,000	
b. Collect data on indicators.		Database	MEWC. MHCC	NSSA	ongoing	100,000	
Total						**105,000**	
Objective 3: To assess the effects of POPs and other chemicals on human health and the environment within five years (should be linked with Objective 2 above)							
a. Conduct research on effects of POPS on human health and the environment in targeted populations and affected areas over time.		Number of research papers produced Reports on ecological changes in the environment	Academic and Research Institutions, MEWC	MHCC, MAMID	Five years / ongoing	300,000	
b. Observe, interpret and document abnormal changes		Test results / reports	Academic and Research Institutions, MEWC	MHCC, MAMID	Five years	30,000	
Total						**330,000**	
Objective 4: To capacitate at least 25% of national laboratories to conduct relevant analysis for evidence based decision making within five years							
a. Prioritize laboratories to be capacitated.	Define prioritization criteria. Conduct prioritization.	Document / report detailing prioritized labs	MEWC,	EMA, MHCC, MAMID, MHTESTD	2 months	5,000	The Government has done a lot in this area, having recently purchased state of the art equipment (GC-

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
b. Identify specific capacity needs.	Capacity needs should include capacity for testing, identifying / detecting POPs and other pesticides in different substances/	Report / document on capacity needs assessment Equipment specifications and lists	MEWC,	EMA, MHCC, MAMID, MHTESTD	4 months	5,000	MS) for three Government laboratories, which equipment has the capacity to analyse for POPs.
c. Purchase lab equipment, chemicals and consumables	Purchase the requisite equipment and consumables.	Equipment purchased and commissioned Chemicals and consumable in place	MEWC, EMA, MHCC, MAMID	MHTESTD	12 months	1,000,000	
d. Conduct training / capacity building.	Train laboratory staff in using new equipment. Participate in relevant conferences.	Training reports	MEWC, MHTESTD	EMA, MHCC, MAMID	18 months	200,000	
Total						**1,210,000**	
Objective 5: To develop a good science – policy interface by which policy will advise the research sector on areas requiring research, and the research sector conducts research on these and informs policy within one year							
a. Identify experts to develop strategy for achieving a good science-policy interface.		ToRs Contract with selected expert signed	MEWC	MHTESTD, MHCC	4 months	2,000	
b. Develop and implement strategy.		Strategy developed and available	MEWC	MHTESTD, MHCC	8 months	10,000	
Total						**12,000**	

Activity		Success Indicators	Lead Responsibility	Supporting Organisations	Duration	Budget	Comments on Implementation Status (where applicable)
Objective 6: To strengthen capacity for chemicals data management within three years							
a. Conduct needs assessment to identify gaps in chemicals data management (chemicals data needs)		Assessment report	MEWC	ZIMSTAT, ZIMRA, MAMID, MHCC, MLGPWNH, Local authorities, Academia, NSSA, Manufacturers, EMA	6 months	1,500	
b. Develop guidelines / strategy for chemicals data management.	Develop strategy which identifies how requisite chemicals data will be collected, analyzed and managed, and how the information will be disseminated.	Guidelines prepared	MEWC	ZIMSTAT , ZIMRA, Agriculture, MHCC, MLGPWNH, Local authorities, Academia, NSSA, Manufacturers, EMA	6 months	15,000	
c. Create the required databases (central repository), and ensure that the information on where the repositories are housed, is made available.	Develop databases. Ensure that information on where the repositories are housed, is made available by putting it on the websites of relevant Ministries.	Databases in place Information on location of databases available on websites of MEWC	MEWC	MHCC, EMA, NSSA, MAMID, MHTESTD	3 months	10,000	
Total						**26,500**	

Grand Total for all the action plans: **US$51,423,500**

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Annexes

Annex 1: Members of the POPs National Coordinating Committee

NAME	ORGANIZATION
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Ms. P. Dhlakama	MEWC
Mr. Karembera	MEWC
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Annex 1: List of Participants to the NIP Endorsement Workshop

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