UPDATING THE NATIONAL IMPLEMENTATION PLAN (NIP) UNDER THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS

CONSULTANCY ON POPs PESTICIDES
FINAL DRAFT REPORT

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EXECUTIVE SUMMARY

The Stockholm Convention is a global agreement whose objective is to protect human health and the environment from Persistent Organic Pollutants (POPs). These are a group of organic chemicals which have been intentionally produced and introduced into the environment. Due to their known health and environmental impacts, the Convention requires that Parties adopt and introduce measures to reduce or eliminate releases of POPs into the environment.

Kenya is a party to Stockholm Convention on Persistent Organic Pollutants (POPs) and ratified the Stockholm Convention on September 2004. There after developed its first National implementation Plan (NIP) which was adopted in 2007. The convention initially listed 12 POPs, eight of which were pesticides. During the 2009 and 2011 meetings the Conference of Parties (COP) adopted the amendments to Annexes A, B and C to the Stockholm Convention to list ten new POPs of which six were pesticides. The old POPs included Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobezen Mirex and Dichlorodihenyl Trichlorethane. The new POPs are Alpha hexachlorocyclohexane, Beta hexachlorocychlohexane, Chlordecone, Lindane, Pentachlorobenzene and Endosulfan.

Pursuant to Article 7 of the Stockholm Convention member parties were obligated to update their NIP to address the new POPs.

The process of updating the NIPs requires Kenya to carry out inventories of pesticide POPs listed above and establish their status in the country. The introduction of six new pesticides to the POPs list in 2009 and 2011 added to the amounts of obsolete stocks targeted for elimination

The new Pesticide POPs are listed in Annex A of the Convention, meaning that Parties are required to eliminate all production and use of that substance (except in areas where specific exemptions have been claimed)

The first inventory carried out in 2006 was to identify whether the initially listed pesticide POPs in the Stockholm Convention were produced, used, imported/exported or whether there were stockpiles/obsolete wastes in the country followed by subsequent production of NIP 2007

A comprehensive inventory was carried out as reported in the two documents although not all targeted areas/sites were visited.

In this report a review of Kenya NIP 2007 reported with the findings stockpiles, obsolete chemicals and waste, priorities listed and actions taken with reference to the priorities . it was noted that most of the disposal of obsolete chemical waste has been carried out by PCPB which is the statutory organization of Kenya Government that is mandated to regulate the use and control of pesticide products in the country, as prescribed in the Pest Control Product Act.

The contaminated sites in Kenya include Kitengela, Menengai, Wajir and Madera. The sites were contaminated through burial of pesticides. During the time of deposition of the obsolete pesticides there was no human or animal habitation in those areas. However, currently human beings and animal habitation has spread in these areas. There is potential risk to both flora and

fauna in these areas and their neighborhood. Mitigation is by excavation and safe disposal of the contaminated soils in these areas.

Other stakeholders who have taken part in the disposal of obsolete pesticide and associated wastes from Kenya have also been highlighted, e.g. CleanFarms Safeguarding Project which is an initiative of the Ministry of Agriculture and CropLife International

47 tonnes of obsolete pesticides and hazardous pesticides out of the identified 222 tonnes in Kenya were shipped for disposal by Veolia in United Kingdom with funding provided by Food and Agricultural Organization and CropLife International.
During surveillance by PCPB compliance inspectors, illegal pesticides are impounded and collected. By December 2013, there was about 100 tonnes of pesticides due for disposal around the country in pilot collection centres (PCPB).

Chapter 2 of this report gives background information with regard to the new pesticide POPs and assessment of their current status in the country. For these POPs, (Alpha hexachlorocyclohexane (α- HCH) Beta hexachlorocyclohexane (β- HCH), Chlordecone, Pentachlorobenzene (PeCB)) Kenya has no registered uses for these POPs; therefore, no production, use or sale in Kenya as pesticides. However, lindane have been registered for use in the country for seed dressing only and endolsulfan used as insecticide for control of tsetse fly and various crops.

Once amendments to Annexes A, B or C of the Convention of adding new POPs enter into force, Parties are required to develop inventories for those substances so that information at the country level becomes available.
Chapter 3 outlines the methodology used to achieve the goals of the inventory with specific activities which included desktop **r**eview of data available in the country, imports, use, storage locations, private sector sales data, management practices, historical reports etc
For field visits, site inspection of storage, use, stockpiles or wastes, location, quantity, source etc. was also carried out. This required staff with training on inventory taking and aware of the hazards associated with it. Training and the necessary information was availed before the commencement of field visits. Consultation and participation of key stakeholders was crucial to help ensure that necessary information was made available; and further to strengthen the reliability of the results.
Stakeholders from Pesticide Control Products Board, Ministry of Health, Government Chemists, Research Institutes (ICIPE) and Universities were also consulted.

In chapter 4, the results of the inventory from the selected areas are tabled. Generally no stockpiles or obsolete pesticide P0Ps were reported in all the areas visited except for a few expired chemicals not necessarily POPs that were reported in two sites. However there is need to enforce surveillance of regulated chemicals across the boarders and monitoring programme should be carried out periodically in order to note the trend of these chemicals in the environment.

A review of alternative products, to DDT and other POPs methods and strategies, their efficacy and cost effectiveness, towards healthcare and reduction of vector born diseases has been outlined with a detailed list of products given in the Annex. The alternatives recommended by POPRC are also given.

Bendiocarb which is one of the alternative chemical recommended was tried in Western Kenya and found to be suitable alternative for mosquito vectors which are resistant to pyrethroids. Community acceptability was high at 95% as evidenced in the study conducted in western Kenya in 2011 (KEMRI) but are more expensive compared to pyrethroids
Some of the IVM approaches include the use of insecticide-treated nets (ITN), proper use of mosquito nets and environmental management for malaria vector control, including draining, filling and covering of mosquito larval habitats, use of bio-larvicides and mosquito proofing of houses. In 2004, the WHO adopted IVM globally for the control of all vector-borne diseases. IVM strategies have been initiated in Kenya by various institutions including the Ministry of Health, research institutions and Universities and the Stockholm Regional Centre in Kenya based at the International Centre of Insect Physiology and Ecology (*icipe*).

The International Centre of Insect Physiology and Ecology **(*icipe***) was nominated by the African region to serve as a Stockholm Convention regional centre in July 2010. It was endorsed in 2011 as a regional or sub-regional centre for capacity building and the transfer of technology by COP 5 for four years. In particular, the regional centre focuses on capacity building and transfer of technology in non-chemical alternatives to the use of persistence organic pollutants (POPs) in management of disease vectors and pests. It maintains strong collaboration with the Stockholm Convention focal point in Kenya.

ICIPE undertakes research, capacity building, institutional development and technology transfer in alternative eco-friendly methods for control of vectors of tropical diseases without the use of persistent organic pollutants (POPs), particularly DDT for malaria control. These are implemented as part of integrated vector management (IVM) strategies. The following are some of the activities that have been undertaken: Alternatives to POPs for pest control and for animal disease vector control
The challenges and needs to combat malaria includes among others:

- Funding to increase the national policy and management capacity for translating international best practices (BEP and BATS) on disease vector control and implementing quality assurance systems to assess programme performance and impact.
- Strengthening the Stockholm Regional Centre in Kenya for capacity building and transfer of technology to the parties.
- Implementation of IVM and screening of more products for vector control

In conclusion monitoring programme should be carried out periodically in order to note the trend of these chemicals in the environment and epidemiological studies should be carried out once a new chemical is in use in the country. Since there are no uses of these POPs other than their historical use as pesticides, no additional measures other than those applied through the PCPB are required for Kenya to meet its obligations under the Stockholm Convention for elimination of the production and use of new pesticide POPs.

Abbreviations

AAK – Agro-Chemical Association of Kenya

α-HCH Alpha hexachlorocyclohexane

ASP – African Stockpiles Program

BAT - Best Available Technology

BEP – Best Environmental Practices

β -HCH Beta hexachlorocyclohexane

COP – Conference of Parties

EMCA – Environmental Management Coordination Act

FAO – Food and Agricultural Organization

GEF – Global Environmental Facility

HCH - Hexachlorocyclohexane

ICIPE – International Center for Insect Physiology and Ecology

IPM – Integrated Pest Management

IVM – Integrated Vector Managemen

KARI – Kenya Agricultural Research Institute Kenya Bureau of Standards

KEMFRI– Kenya Marine and Fisheries Research Institute

KEMRI– Kenya Medical Research Institute

KEPHIS– Kenya Plant Health Inspectorate Services

KETRI– Kenya Trypanosomiasis Research Institute

KFA – Kenya Farmers Association

KIRDI – Kenya Industrial Research and Development Institute

KRA – Kenya Revenue Authority

MEAs – Multilateral Environmental Agreements

MENR – Ministry of Environment and Natural Resources

MOA – Ministry of Agriculture

MOPH&S – Ministry of Public Health & Sanitation

MOH – Ministry of Health

NEMA – National Environmental Management Authority

PCPB - Pest Control Products Board

POPRC - Persistent Organic Pollutants committee

POPs - Persistent Organic Pollutants

UNEP - United Nations Environmental Programme

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1.0 Introduction

The Stockholm Convention is a global agreement whose objective is to protect human health and the environment from Persistent Organic Pollutants (POPs). POPs are a group of organic chemicals which have been intentionally or inadvertently produced and introduced into the environment. Due to their stability and transport properties, they are now widely distributed around the world, and are even found in places where they had never been used, and are known to effect toxicity. Given their long half-lives and fat solubility, they tend to biomagnify along the food chain in living organisms, particularly in long-lived species at the top of the food chain. POPs appear at higher concentrations in fat-containing foods, including fish, meat, eggs and milk. They can be introduced into humans through the food chain and consequently, are passed on from mother to child across the placenta and through breast milk. Specific effects of POPs include cancer, allergies and hypersensitivity, damage to the central and peripheral nervous systems, reproductive disorders, and disruption of the immune system. Some POPs are also considered to be endocrine disrupters, which, by altering the hormonal system, can damage the reproductive and immune systems of exposed individuals as well as their offspring; they can also have developmental and carcinogenic effects.

Due to their known health and environmental impacts, the Convention requires that Parties adopt and introduce measures to reduce or eliminate releases of POPs into the environment.

The convention initially listed 12 POPs, nine of which are pesticides. In 2009 and 2011, the Conference of Parties (COP) adopted amendments to annexes A, B, and C to the Stockholm Convention to list ten new POPs, six of which are pesticides. The pesticides listed in the Convention are aldrin, alpha- hexachlorocyclohexane, beta-hexachlorocyclohexane, chlordane, chlordecone, DDT, dieldrin, technical endosulfan, and its related isomers, endrin, heptachlor, lindane, mirex, pentachlorobenzene, and toxaphene.

The new Pesticide POPs are listed in Annex A of the Convention, meaning that Parties are required to eliminate all production and use of that substance (except in areas where specific exemptions have been claimed (Table 1)

TABLE 1: the new Pesticide POPs in Annex 1

Chemicals	**Annex**	**Specific exemptions/Acceptable purposes**
Alpha hexachlorocyclohexane	**A**	Production: none/use: none
Beta hexachlorocyclohexane	**A**	Production: none/use: none
Chlordecone	**A**	Production: none/use: none
Lindane	**A**	Production: none/use: none
pentachlorobenzene	**A and C**	Production: none/use: none

Endolsulfan	**A**	Production: none/use: none

1.1 Obligations under the Stockholm Convention

Each Party to the Stockholm Convention is required, under Article 7 of the Convention, to develop a National Implementation Plan (NIP) demonstrating how it will implement its obligations under the Convention. Kenya submitted its NIP to the Stockholm Convention Secretarit year 2007 covering the initially listed POPs (2004.)

Article 7. 3(c) of Stockholm Convention

- states that each Party shall 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 Parties.
- Identification of factors leading to a need to review and update NIPs pursuant to article 7 are:
- External and internal factors referred to paragraph 4 and 5 of the annex decision SC 1/ 2
- As part of NIP review and update, Parties should also evaluate the efficacy of the adopted action plans, strategy and measures included in their first or last updated NIPs.

The process of updating the NIPs requires Kenya to carry out inventories of the new pesticide POPs listed above and establish their status in the country. The introduction of six new pesticides to the POPs list in 2009 and 2011 added to the amounts of obsolete stocks targeted for elimination

1.2 Review of inventory 2006 and NIP 2007

In this review the following was taken into consideration:

- Assessment and evaluation of the action taken of what was proposed in the last NIP (2007), and follow up. This was to provide baseline information on strategies adopted/ planned activities.
- Review changes and factors influencing changes e.g. ban on use, restriction or use of alternatives introduced, identify gaps and update data
- Current status with regard to the initial POPs pesticides/situation/control measures-destruction of stockpiles or remedial actions taken
- Evaluate effectives of strategies and report such review to address article 15.

1.2.1 Assessment and Evaluation of Pesticide POPs (NIP 2007)

The Actions Taken With Reference To The Priorities Listed In Kenya NIP 2007

(Annex 1 For Pesticide Pops And DDT.)

The report summary is given in the Annex.1. Most of the institutions responsible for various

activities have not reported any activity. NEMA, being the coordinating unit has not reported whether the institution were aware of their responsibility or funds were not available. PCPB have reported some of the activities being part of their continuous institutional functions and strategic plans.

However, a number of activities have been carried out and others being implemented as follows:

1) Development of pesticide POPs alternatives including DDT by research institutions mainly ICIPE and KEMRI which is a continuous process
   A number of pesticide POPs alternatives have been tested and are registered in PCPB Chemical Registry (Revised edition 2013)
2) In 2008 the Ministry of Agriculture and CropLife International established CleanFarms Safeguarding Project in Kenya with the aim of mapping out obsolete pesticides and associated wastes plus the risks associated.
   Awareness campaigns to farming communities, municipalities, distributors, government agencies and large scale farmers have been carried out and 47 tonnes of obsolete pesticides and hazardous pesticides out of the identified 222 tonnes in Kenya were shipped for disposal by Veolia in United Kingdom with funding provided by Food and Agricultural Organization and CropLife International. Ministry of Agriculture (PCPB), CropLife Kenya Participated.

The Environmental and Combustion Consultants Ltd (ECC) of Kenya and Veolia of UK were involved in the safeguarding of the obsolete pesticides for safe transportation to the Temporary Storage Facility in Kabete.

However, 175 tonnes of the remaining pesticides stock is still stored and safeguarded at Kabete Temporary Storage Facility. Additional stocks will be generated from the ongoing National collection and safeguarding activity, the collected and safeguarded stocks will be destroyed through approved incineration facilities.(PCPB)

The information gained in the Clean Farms Safeguarding Project initiative, will assist in forward planning on the way to manage obsolete pesticides in Kenya, contributing to acceleration of the overall Africa Stockpiles and to risk-reduction.

3) Kenya is part of Global monitoring Plan (GMP) Project (monitoring of POPs in different media)

A training workshop sponsored by the UNEP/GEF on the analysis of POPs pesticides and PCBs was conducted on 8-15 January 2007 at the University of Nairobi. This was under Global Monitoring Plan for POPs under Stockholm Convention

The reported data in **air and mother's milk** is an indication of levels of pesticide POPs in the environment.

This may reflect the effectiveness of measures taken to implement the Convention but the changes in levels can be only be evaluated after a number of monitoring studies has been conducted within certain time intervals.

Lack of monitoring protocol, limited funds and appropriate capacity to conduct the required analyses has affected the residue analyses.

The Africa Stockpiles Programme (ASP)

Kenya has ratified the Stockholm Convention and therefore qualifies to benefit from the

Africa Stockpiles Programme (ASP). The ASP complements the Stockholm Convention in addressing chemical and hazardous materials

At the global level, ASP contribute to international efforts to eliminate POPs, improve the management of toxic chemicals and promote integrated pest management. Clean-up and disposal activities are a direct implementation of the Stockholm POPs Convention and the associated GEF operational programme aiming to reduce the impacts of POPs on the global food chain, transboundary waters, soil and biodiversity.
The ASP contributes to the objectives of other international agreements such as the Rotterdam and Basel Conventions. This is a necessary tool for Kenya in addressing the transboundary movement of POPs with the neighbouring countries.

1.2.2 Current National Status of pesticide POPs

The initial pesticides POPs listed in the Convention (Annex A) are aldrin, chlordane, dieldrin, endrin, heptachlor, mirex, toxaphene and DDT (Annex B)

Article 3 requires parties to take measures to reduce or eliminate releases from intentional production and use.

Prohibition and/or Elimination of Production and Use of Chemicals Listed in Annex A

Article 3.1 Each Party shall:

(a) Prohibit and/or take the legal and administrative measures necessary to eliminate:

(i) Its production and use of the chemicals listed in Annex A subject to the provisions of that Annex

Restriction of Production and Use of Chemicals Listed in Annex B

Article 3.1 Each Party shall: ...

(b) Restrict its production and use of the chemicals listed in Annex B in accordance with the provisions of that Annex.

Kenya has taken legal and administrative measures necessary to eliminate the use pesticide pops in compliance to the Stockholm convention. Table 3 gives a summary of current status of initial pesticide POPs, control measures, destruction of stockpiles and remedial actions taken by PCPB.

TABLE 2: Current Legal status with regard to initial POPs pesticides

Chemical Name	Stockpiles, Contaminated Sites and Wastes	Action and Measures	Legal framework
Aldrin	None	Banned in 2004 Awareness creation by training and publication	Pest Control Products Act
Chlordane	None	Banned in 1986 Awareness creation by training and publication	Pest Control Products Act
Dieldrin	None	Banned in 2004 Awareness creation by training and publication	Pest Control Products Act
Endrin	None	Banned in 1986 Awareness creation by training and publication	Pest Control Products Act
Heptachlor	None	Banned in 1986 Awareness creation by training and publication	Pest Control Products Act
Hexachlorobenze (HCB)	None	Banned in 2004 Awareness creation by training and publication	Pest Control Products Act
Mirex	None	Never imported	Pest Control Products Act
Toxaphene	None	Banned 1986 Awareness creation by training and publication	Pest Control Products Act

Note: Mirex never imported or used in Kenya. None of the POPs pesticides listed above were imported into the country after ban. Source: PCPB. Kenya has not registered any specific exemptions for use and/or production.

1.2.3 Disposal of stocks already identified and decontamination of sites

The contaminated sites in Kenya include Kitengela, Menengai, Wajir and Madera. The sites were contaminated through burial of pesticides. During the time of deposition of the obsolete pesticides there was no human or animal habitation in those areas. However, currently human beings and animal habitation has spread in these areas. There is potential risk to both flora and fauna in these areas and their neighborhood.

There were no activities carried out to clean up contaminated sites before the ban of the said pesticides. However, natural recovery of those sites has been observed in Menengai and Kitengela areas. Follow up studies by PCPB have been done to assess the level of contamination. Soil samples were sent to Europe for analysis but the results are yet to be received from the consultant. As noted Kenya has taken the administrative measures necessary to eliminate the import of chemicals listed as Annex A and B pesticides by banning or restricting their use

Along with the disposal process, a number of activities are being implemented to prevent future pesticides accumulation. These activities include

- Development and enforcement of pesticide policy,
- Development and the implementation of Integrated Pest Management (IPM)
- Development and implementation of Integrated Vector Management (IVM),
- Capacity building in terms of providing professional trainings,
- Creating awareness among stakeholders and
- Enforcement of national legislations and policies related to pesticides use.

The stakeholders in the pesticide industry continued support will help to clear the farms of unwanted pesticides, reducing both environmental and human risk. There is therefore need to encourage farmers, distributors, stockists, ranchers and other stakeholders to surrender the obsolete stocks to the Clean Farms Safeguarding Project for safe disposal in licensed facilities.

1.2.4 Evaluate effectives of strategies and report such review to address article 15.

Kenya participated in Global Monitoring Plan for POPs under Stockholm Convention sponsored by UNEP/GEF

The reported data in air and mother's milk is an indication of levels of pesticide POPs in the environment *[Ref. Kenya POPs National report, 2012]*

This may reflect the effectiveness of measures taken to implement the Convention but the changes in levels can be only be evaluated after a number of monitoring studies has been conducted within certain time intervals.

Lack of monitoring protocol, limited funds and appropriate capacity to conduct the required analyses has affected the monitoring studies..

1.2.5 Importation and exportation of Pest Control Products

The report indicated that none of the listed POPs pesticides are produced in Kenya. There are about ten firms in Kenya (report 2007) formulating and distributing various pesticides in the country. The companies import active ingredients and undertake formulations locally. The Companies are mainly multinationals. There are other pesticides companies that import large volumes of pesticides and repack them locally.

Importation, export and use of pesticides are regulated under Pest Control Products Act, cap 346, Laws of Kenya while stockpiles and wastes containing pesticides POPs are controlled under both PCP Act, 1982 and EMCA, 1999.

Pesticides have been widely used for vector control, crop production and for public health purposes. Since Kenya is predominantly an agricultural country with a high population growth, the demand for pesticides is relatively high and the demand for export to the neighbouring country continues to grow.

Report from PCPB indicates that there was also an increase of the volume of pest control products exported to the neighbouring countries evidenced by an increase in the number of processed applications for export (PCPB, 2009/10)

As shown in Table 2, pesticide imports into the country show an upward trend especially in the insecticides group of compounds. Pesticides import data by PCPB shows that 2006/2007 8749 tonnes, 2007/2008, 9157 tonnes 2008/2009, 9681 tonnes and 2009/2010 8832 tonnes of pesticides were imported.

TABLE 3: **Volume and value of pesticide imported from 2006/2007 – 2009/2010

Category	**2006/2007**		**2007/2008**		**2008/2009**		**2009/2010**	
	Quantity in tons	Value in million Ksh	Quantity in tons	Value in million Ksh	Quantity in tons	Value in million Ksh	Quantity in tons	Value in million Ksh
Insecticide	2475	1181	2887	3909	2995	2079	3181	2493
Fungicide	3190	1251	2651	602	2340	3153	2415	3874
Herbicide	1859	324	2289	206	2933	944	1840	939
*Others	1225	362	1330	191	1413	1167	1396	918
TOTAL	**8749**	**3443**	**9157**	**4908**	**9681**	**7343**	**8832**	**8232**

*Include growth regulators, surfactants and biopesticides.

**Source: PCPB Annual Report 2009/2010.

From the table above, approximately 8832 metric tons of pesticides valued at Ksh 8.2 billion were imported into the country in 2009/2010. During this period, insecticides represented the

largest quantities of pest control products imported, indicating an increase from the previous years.

1.3 Legal and Institutional Framework

The Ministry of Environment, Water and Natural Resources is mandated to protect, conserve and sustainably manage the environment and natural resources in the country.
Sustainable management is linked to the improvement in the economic and social conditions of Kenyans hence the objective of achieving equity, ecological sustainability and economic growth.
The Ministry of Water Environment and Natural Resources is therefore expected to play a major role in meeting this global and national objective through action at national and international levels.
Pesticides play a vital role in pests and diseases management hence enhancing agricultural and livestock productivity. Their use also poses risks to the environment, users, non target species and thus despite enhancing food productivity may impact negatively on food safety, a critical component of food security.

The Pest Control Products Board (PCPB) is a statutory organization of the Kenya Government established under the Pest Control Products Act, Cap 346, Laws of Kenya. The Board regulates the importation, exportation, manufacture, distribution and use of Pest Control Products (Pesticides). The Board since establishment in 1984 has registered many pest control products, which are available to the public for use in public health, livestock and agriculture.
In its regulatory function the Board may suspend, ban or restrict pest control products. Normally banning or restriction follows the recommendations of the Multilateral Environmental Agreements (MEAs), which the Kenya Government have ratified e.g. Basel Convention on Trans-boundary movement of certain hazardous chemicals, the Rotterdam Convention of Prior Informed Consent and the Stockholm Convention on Persistent Organic Pollutants. A list of products that have been banned in Kenya in line with Rotterdam and Stockholm Convention are given in Annex 3.
The Board also inspects the licensed premises dealing with pesticides and together with other stakeholders impounds any illegal products, counterfeit products, unregistered, smuggled, improperly or unlabelled, expired and repacked products.
In addition, the Environmental and Coordinating Act 1999 partially addresses the risks and hazards related to the use of hazardous chemicals,. This act is implemented by NEMA while the Occupational Health and Safety Act Cap 514 deals with the safety and health in relation to protection of workers at the work place. There is also the Food, Drugs and Chemical Substance Act Cap 254 which deals with chemicals that may contaminate food including pesticides but does not address the handling and management of POPs pesticides. Below is the list of other legislations that address chemicals management in Kenya:

- Public health act Cap 242 laws of Kenya.
- Pharmacy and poisons act Cap 244 Laws of Kenya.
- Malaria prevention act, CAP 246 Laws of Kenya.
- Local Government Act Cap 265 Laws of Kenya.
- Fertilizers and animal food stuff Cap 345 Laws of Kenya.
- Cattle cleansing Act Cap 350 Laws of Kenya.

- Water Act No. 8 of 2002.

Members involved in pesticide sector include:

- National Environment Management Authority
- Pest Control Products Board;
- Kenya Plant Health Inspectorate Services (KEPHIS);
- Kenya Agricultural Research Institute;
- Agrochemical Association of Kenya;
- Ministry of Agriculture:
- Kenya Bureau of Standards
- Fresh Produce Exporters of Kenya
- Kenya Flower Council
- Horticultural Crops Development Authority

The National Environment Management Authority (NEMA) is established under the Environmental Management and Coordination Act (EMCA) No. 8 of 1999, as the principal instrument of Government for the implementation of all policies relating to the environment.

It is also important to note that the Kenya Constitution 2010, also, ushered a new devolved system of governance which created 47 counties. Each county is expected to design its own best practices of environmental governance in harmony with the Constitution, Kenyan laws and guidelines for resources management as stipulated by NEMA regulations.

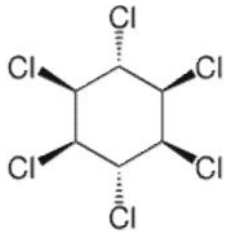
2.0 Overview of the New POPs Pesticides

Pesticides play a vital role in pests and disease management hence enhancing agricultural and livestock productivity. Their use also poses risks to the environment, users, non target species. Therefore, despite enhancing food and livestock productivity, they may impact negatively on food safety, a critical component of food security. During the 2009 and 2011 meetings the Conference of Parties (COP) adopted the amendments to Annexes A, B and C to the Stockholm Convention to list ten new POPs of which six were pesticides. The old POPs included Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexachlorobezen Mirex and Dichlorodihenyl Trichlorethane. The new POPs are Alpha hexachlorocyclohexane, Beta hexachlorocychlohexane, Chlordecone, Lindane, Pentachlorobenzene and Endosulfan.
Pursuant to Article 7 of the Stockholm Convention member parties were obligated to update their NIP to address the new POPs.

2.1 Alpha hexachlorocyclohexane (α- HCH)

Hexachlorocyclohexane (HCH) is a six chlorine substituted cyclohexane, a synthetic chemical consisting of eight isomers. Only four of these isomers—α-HCH, β-HCH, γ-HCH, and δ-HCH—are of commercial significance.

Structure of Alpha hexachlorocyclohexane (α-HCH)



Chemical formula $C_6H_6Cl_6$

Alpha hexachlorocyclohexane (α-HCH) is listed in Annex A of the Stockholm Convention without exemptions; hence Parties have to stop all production and use.
Alpha and beta hexachlorocyclohexane (α-& β- HCH) were previously important components of the pesticide technical HCH,
Alpha-HCH by itself is not intentionally produced or commercialized. It is produced as the main constituent of technical HCH which was used as an organochlorine insecticide. Technical HCH consists of 70 % alpha-HCH, 7 % beta-HCH and 13 % gamma-HCH.
Alpha-HCH was also a known by-product in the manufacture of gamma-HCH (lindane).
Lindane (99% by weight gamma HCH), which replaced Technical HCH, contains only trace amounts of alpha and beta HCH. As significant quantities of waste were generated in the production of lindane, this may have contained the alpha and beta HCH isomers.

2.1.1 Environmental contamination

α- HCH was released during the production and use as a pesticide of technical HCH. Releases into the environment are also possible from hazardous waste sites, stockpiles and residues of lindane production. Contaminated sites where technical HCH has been used may also contribute to the environmental burden of α- HCH.
Humans are generally exposed to α- HCH from ingestion of contaminated foods, inhalation, consumption of contaminated water are minor sources of exposure. Infants may also be exposed during fetal development and breast feeding as a result of maternal uptake from the environmental because of the bioavailability of α- HCH.
α-HCH is also present in terrestrial and aquatic food chains; levels vary depending on species and location. It is also the most dominant isomer in fish and may biomagnify in biota and aquatic food chains.

2.1.2 Health effects

Workers exposed to technical HCH during pesticide or fertilizer formulation have reported neurophysiological and neuropsychological disorders and gastrointestinal disturbances. The effects range from headache, giddiness, vomiting, tremors, apprehension, confusion, to loss of sleep among others. Hepatic effects have also been observed in animals.
No specific studies are available on the effects of α- HCH on humans, but experimental studies show liver and kidney damage. It is also reported to have effects on immune system and immunosuppressive effects have been seen in humans exposed totechnical HCH.

2.1.3 Levels of α-HCH in different media (Tables 4- 8

Hexachlorocyclohexane (HCH) pesticide residues in water, sediment samples, fish and human milk samples are reported

2.1.4 Production, use, import export in Kenya

Has not been used in Kenya (PCPB)

2.2 Beta hexachlorocyclohexane (β- HCH)

Beta hexachlorocyclohexane is listed in Annex A of the Stockholm Convention without exemptions; hence production and use have to be eliminated by Parties

Beta hexachlorocyclohexane (β -HCH) is one of the five stable isomers of technical HCH, an organochlorine pesticide formerly used in agriculture. The modes of action of the HCH isomers differ quantitatively and qualitatively with regard to their biological activity in the central nervous system as the main target organ. β -HCH is mainly a depressant and the final effect of the mixed isomers depends on the composition.

β -HCH is the most persistent isomer, with half-lives of 184 and 100 days on cropped and plots with no crops. It the predominant isomer in soils and animal tissues because its configuration favours storage in biological media and affords it greater resistance to hydrolysis and enzymatic degradation.

β -HCH by itself is neither intentionally produced nor placed on the market. It is produced as constituent of technical HCH used as organochlorine insecticide or chemical intermediate to manufacture enriched γ-HCH (lindane).

Prenatal exposure to β-HCH, an isomer of lindane and production byproduct, has been associated with altered thyroid hormone levels and could affect brain development.

2.2.1 Environmental contamination

It is released during the manufacture of technical HCH and its use as a pesticide. Due to the past extensive use, persistence and long range transport α and β-HCH can be detected in all environmental media including humans. Human exposure to these chemicals results mostly from ingestion of contaminated plants, animals and animal products. High exposure is expected in contaminated areas due to extensive use, production, disposal sites and stockpiles.

2.2.2 Health effects

Workers exposed to technical HCH during pesticide or fertilizer formulation have reported neurophysiological and neuropsychological disorders and gastrointestinal disturbances. Inhalation of HCH (mixed isomers) may lead to irritation of the nose and throat. The observation of serious hepatic effects in animals suggests that the same could potentially occur in workers following prolonged occupational exposure.

Children are more vulnerable against chemical substances than adults but it is not known if they are more susceptible than adults to health effects from exposure to β-HCH. Placental transfer of HCH in humans has been well documented and because β-HCH is lipophilic and

accumulates in adipose tissue and breast milk, this is one of the ways of children exposure to β-HCH
Dietary exposures to animals have reported liver and renal effects.

2.2.3 Levels of β -HCH in different media are given in Tables 4- 8.

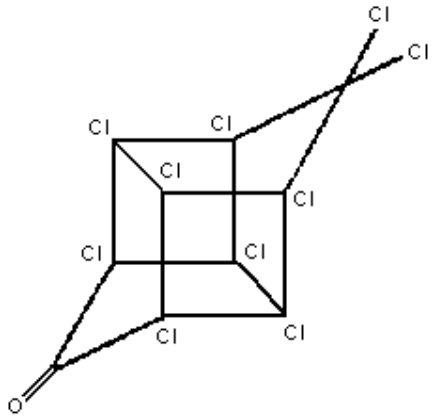
Hexachlorocyclohexane (HCH) pesticide residues in water, sediment samples, fish and human milk samples are reported

2.2.4 Production, use, import export in Kenya

Has not been used in Kenya (PCPB)

2.3 Chlordecone

Chlordecone is listed in Annex A of the Stockholm Convention without exemption hence all production and use have to be stopped by Party countries.
Chemical structure



Molecular formular: $C_{10}Cl_{10}O$
Chlordecone is a synthetic chlorinated compound, (chemically related to Mirex) which was mainly used as an agricultural insecticide, miticide and fungicide.
It was first produced in 1951 and introduced commercially in 1958. In Kenya Chlordecone was sold under the trade name 'Kepone'

2.3.1 Main uses and applications

Chlordecone is no longer produced or used, but it has been used in various parts of the world for the control of a wide range of pests, specifically, it has been used extensively in the tropics for the control of the banana root borer. It has also been used as a fly larvicide. Also as a fungicide against apple scab and powdery mildew. Chlordecone has also been used for the control the Colorado potato beetle, rust mite on non-bearing citrus and potato and tobacco wireworm on gladioli and other plants. It is regarded as an effective insecticide against leaf-cutting insects, but less effective against sucking insects.
Chlordecone has also been used in household products such as ant and roach traps.

2.3.2 Risk profile

The effects of exposure to chlordecone have been observed in laboratory animals, in the environment and humans. Studies show that chlordecone is readily absorbed into the body and accumulates following prolonged exposure. The pesticide is both acutely and chronically toxic. Its adverse effects include neurotoxicity, immunotoxicity, reproductive, musculoskeletal and liver toxicity, and liver cancer. The International Agency for Research on Cancer has classified chlordecone as a possible human carcinogen (IARC group 2B). Chlordecone is absorbed through inhalation, oral, and dermal routes of exposure.

2.3.3 Production, use, import export in Kenya

There is no indication of its registration, use, importation or exportation in Kenya.
(Source: PCPB)

2.4 Lindane (gamma hexachlorocyclohexane (γ-HCH)

Lindane is listed in annex A of the Stockholm Convention with no specific exemption for production; there is a specific exemption for use as human health pharmaceutical for control of head lice and scabies as second line treatment, which allows existing stocks to be used for such purpose following World Health Organization (WHO) guidelines.
Lindane has been used globally as a broad-spectrum insecticide for seed and soil treatment, foliar applications on crops, tree and wood treatment and against ectoparasites in both veterinary and human applications. The estimated worldwide use in 1990 was 8,400 tonnes. The production of lindane has decreased rapidly in recent years and it is now only produced in a few countries.
Lindane can be found in all environmental compartments. Levels in air, water, soil, sediment, aquatic and terrestrial organisms and food have been assessed worldwide.

2.4.1 Impact on Human Health

Detectable levels in human blood, adipose tissue and breast milk indicate that widespread human exposure occurs. Most lindane adverse effects on human health reported have been related to agricultural uses and chronic occupational exposure of seed-treatment workers.
Lindane is the most acutely toxic HCH isomer. It affects the central nervous and endocrine system in humans. Effects from acute exposure at high concentrations may range from mild skin irritations to dizziness, headaches, diarrheal, nausea, vomiting, and even convulsions and death. The routes of potential human exposure to lindane and other hexachlorocyclohexane isomers are ingestion, inhalation, and dermal contact. The general population potentially is exposed through consumption of foodstuffs contaminated with pesticide residues

2.4.2 Environmental contamination

Lindane being a persistent organic pollutant is relatively long-lived in the environment, it is transported long distances by natural processes and it can **bioaccumulate** in **food chains**, though it is rapidly eliminated when exposure is discontinued.

The production and agricultural use are the primary causes of environmental contamination, and levels of lindane in the environment have been decreasing globally, consistent with decreasing agricultural usage patterns.

When lindane is used in agriculture, it is known to volatilize into the atmosphere, where it is subject to long-range transport and can be deposited by rainfall. Lindane in soil can leach to surface and even ground water. However, biotransformation and elimination are relatively rapid when exposure is discontinued. Most exposure of the general population to lindane has resulted from agricultural uses and the intake of foods, such as agricultural produce, meats and milk and their products.

2.4.3 Levels of HCH in different media

The beta-isomer of HCH is the most persistent and bioaccumulative form. The alpha- and gamma-isomers of HCH are converted into the beta-isomer in living organisms. As a result of this conversion, as much as 90 percent of HCH detected in human tissues and breast milk is the beta-HCH. As with many other POPs, HCH attaches to soil and sediment particles. However, fungi and bacteria can break HCH down into less harmful substances. HCH isomers, including lindane, are broken down quickly in water. All HCH isomers can accumulate in the fatty tissue of fish and other animals.

TABLE 4: Mean concentration (± SE) of Hexachlorocyclohexane (HCH) pesticide residues in water and sediment samples from Yala/Nzoia Basin

Pesticide	**Water (dry&rainy)**	**Sediment (µgkg/l (dry)**	
α-HCH	ND	4.41	1.81±0.006
β-HCH	ND	2.76	0.92±0.017
γ-HCH	ND	16.03	6.43±0.012

(Gichuki et al 2011)

The presence of lindane in sediment indicates that it is significantly used in the region despite the fact that it is restricted for seed dressing only in Kenya.
These concentrations of lindane in sediments were much higher than those of water probably because of accumulation in the sediments with time. Decomposition of large amounts of biomass enriches the surface sediments with organic carbon which promotes adsorption This, therefore, suggests continuous use of this pesticide for other agricultural purposes apart from seed dressing.
A study carried out in two counties in Kenya compared levels of the HCH group of compounds in different fish organs as shown in table 5 and 6 below.

TABLE 5: Mean concentration of Organochlorine pesticide levels (µg Kg^{-1}) ±SD in various fish organs in Kiambu County.

Organochlorine	Muscle	Liver	Gonad	brain
α-BHC	ND	0.236±0.266	0.383±0.15	0.025±0.024
ɤ-BHC	0.072±0.011	0.013±0.033	0.169±0.45	0.022±0.046
ß-BHC	ND	ND	ND	ND

ND: Not Detected/below detection limit. Source: Omwenga, 2013

Lindane had the highest frequency of occurrence and was detected in 36 samples (16.9%) with a mean concentration of 0.0723 ± 0.011, 0.013± 0.033, 0.169±0.45 and 0.022±0.046 in muscle, liver, gonad and brain respectively in Kiambu county.

α-BHC was detected in 19 samples (8.92%) and ranged between not detectable to 0.236 µg Kg^{-1} with a mean concentration(µg kg^{-1}) of 0.236±0.266, 0.383±0.15 and 0.025±0.024 in liver, gonad and brain respectively in Kiambu County.

TABLE 6: Concentration of Organochlorine pesticide (µg Kg^{-1}) ±SD levels in various fish organs in Machakos County.

Organochlorine	Muscle	liver	Gonad	brain
α-BHC	ND	ND	0.013±0.19	0.011
ɤ-BHC	0.013±0.008	0.073±0.01	0.017±0.029	0.029±0.041
β-BHC	ND	ND	ND	ND

Fish flesh muscle is the edible part of fish and frequently employed in assessing human health risks in relation to fish consumption.

Lindane had the highest frequency of detection in all samples analyzed. This is an indication that some farmers might be illegally using lindane. Lindane was initially used for seed dressing to protect crops against termites. However its agricultural use has been banned in the country due to persistence and toxicity to the untargeted organisms.

The lindane contamination pathways into water bodies are likely to be nonpoint sources via runoff, atmospheric deposition and leaching due to past agricultural applications and vector control as the above tables show that levels were higher in Kiambu which is a more intense agricultural area than Machakos County.

TABLE 7: Mean and range of pesticide residue levels (µg/kg) in Nile perch liver and muscle samples from Lake Victoria, February – June 2001.

Period of sampling 2001		
Pesticide residue	February-June Liver (n=51)	February-June Muscle (n-52)
	Mean(range)	Mean(range)
α-BHC	12.9(2-37)7/51	9.08(1.0-21.8)6/52
β-BHC	31.1(9.3-52.9)5/51	14.8(4.6-40.0)13/52
γ-BHC	5.0(0.9-12.3)14/51	8.23(1.6-75.0)19/52

Residue levels are given on wet weight basis. Mean calculated for the positive samples only.
Positive samples are given as a reciprocal.
(-) Below detection limit.
Source: Mwangi , 2001

The mean level of β-BHC found in the liver was about two times higher than in the muscle. β-BHC is the environmentally most persistent isomer and may have higher ability to accumulate in liver tissue than γ-BHC. However, γ-BHC has also been used as an insecticide in Kenya both in agriculture and livestock as a cattle dip and this may be the reason of its detection in more samples than β-BHC

Increase in human settlement and activity along the shoreline is a major contributor to pollution in the lake ecosystem which requires extensive use of pesticides to produce enough food. Vector control within the lake region, and industrial and sewage effluents draining into the lake adds to the lake pollution.
These residues were detected during the month of March and April when highest rainfall was recorded and possible discharge of polluted water to the lake. However, since Nile perch are migratory fish, the detection of these chemicals might reflect the general level of contamination of the lake rather than just a local contamination. The samples were however not representative of the entire population. Nile Perch are also known to be bottom swimmers, feeding mainly on deposit material which may have residues adsorbed to the bottom and suspended sediments (Bulkley et al 1981) especially those that have been used in the past for a long time in the area.

2.4.4 Levels of HCH in Breast Milk

Studies looking at HCH contamination of human breast milk have been conducted in many countries and technical grade hexachlorocyclohexane and its isomers have been found in breast milk throughout the world. HCH levels vary widely across the globe, with the highest values found in areas of extensive use. However many countries have not conducted multiple

studies over a range of time, which makes it difficult, to draw conclusions about trends or to assess the effects of bans and restrictions. This happens to be the situation in Kenya for all pesticide POPs.

In May 2005, WHO and UNEP entered into a memorandum of agreement for coordination of human milk surveys in Kenya and other countries for the purpose of the Stockholm. Convention.

TABLE 8: Result of Human Milk Surveys in Kenya

Hexachlorocyclohexane (HCH) group	**Concentration ng/g lipid weight**
alpha-HCH	ND
beta-HCH	2.8
gamma-HCH	2.3

The presence of POPs in mothers' milk reflects environmental contamination and use of POPs in the country. Most mothers indicated consumption of mixed diet including fish, eggs and other animal products which are major source of POPs.
Levels of POPs indicated may form baseline levels against which future trends may be evaluated

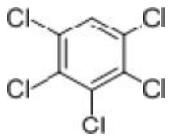
2.4.5 Production, use, import export in Kenya

Previously Lindane was restricted for seed dressing only but was banned in 2011.Specific exemption have been granted to some Parties for pharmaceutical use only.
From the PCPB records, 102 **tons** was approved for import in the year 2009. There has been no importation of lindane in Kenya since 2011 following its ban. In a recent survey carried for purposes of updating NIP 2014, a small stock pile was found in a local seed dressing company.

2.5 Pentachlorobenzene (PeCB)

Pentachlorobenzene (PeCB) is a chemical compound with the molecular formula C_6HCl_5 which is a chlorinated aromatic hydrocarbon. It consists of a benzene ring substituted with five chlorine atoms. PeCB was once used industrially for a variety of uses, but because of environmental concerns there are currently no large scale uses of PeCB

Chemical structure.



Molecular formula C_6HCl_5

PeCB is a persistent organic pollutant with properties for bio accumulation in biological systems and concentrate in food chains. Consequently, it was added in 2009 to the list of chemical compounds covered by the Stockholm Convention

Pentachlorobenzene is listed in Annex A and C of the Stockholm Convention; hence production and use have to be eliminated by Parties without exemption

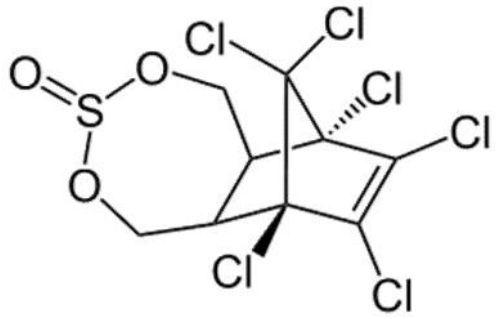
Belongs to a group of chlorobenzene copounds.

2.5.1 Production, marketing, use and control

Pentachlorobenzene (PeCB) is not produced in Kenya and has no current commercial uses. It is present as a contaminant in the pesticide quintozene. .

2.6 Endolsulfan

Chemical Structure



Molecular formula: $C_9H_6Cl_6O_3S$

Endosulfan is listed under Annex A. with no specific exemption. It is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy.

It is not approved for residential use. It is sold as a mixture of two different forms of the same chemical (referred to as α-and β-endosulfan). It is a cream-to-brown-colored solid that may appear crystalline or in flakes. It has a distinct odour similar to turpentine. The use of endosulfan is being restricted to certain crops but was banned for all uses by 2011.

2.6.1 Environmental contamination

The fate of endosulfan released in the environment is different for the two isomers and also depends on the medium it gets deposited. β - endosulfan is more persistent than its α - isomer. Endosulfan sulphate is the main degradation product of both isomers, which is equally toxic and is itself more persistent in the environment than its parent compounds. Endosulfan can be broken down by photolysis *hydrolysis and bio degradation*

The persistence of endosulfan in the environment, which mak it amenable to aerial transport, manifested by presence of residues in the polar region, bioaccumulation and bioconcentration, and toxicity to humans culminated in the listing of the biocide as an Annex A POPs under the Stockholm Convention in 2011.

2.6.2 Health Effects of Endolsufan

The diet is the main source of exposure for the general population. Other routes may be through inhalation or skin contact especially pesticide applicators who do not wear proper protection and other agricultural practices

The main target of endosulfan toxicity is the nervous system. Exposure to high amounts of endosulfan induces hyperactivity and convulsions, regardless of the route of exposure. Severe poisoning may result in death

Endosulfan has been detected in human breast milk, which means that it can be transferred to babies by nursing.

There are no studies of people exposed to low levels of endosulfan for long periods of time but studies in animals have shown that ingestion of contaminated food for long periods of time affects the kidneys. Endosulfan has been shown to affect children in the same manner as adults, causing tremors and seizures after high exposure.

Studies in animals indicate that endosulfan is highly toxic to aquatic organisms even at recommended levels of application. It is particularly toxic to fishes– massive fish kills are reported from many places It also known to causes endocrine problems, reduction of protein in tissues and other health effects.

2.6.3 Levels of Endosulfan in different media

Presented below are baseline data on levels of endosulfan and its isomers obtained from published research reports. Water bodies are the main repositories of most pollutants and rivers are there mode of dispersal.

Lake Naivasha lays in a fertile semi arid basin and is the only freshwater Rift Valley Lake in Kenya, the Lake has no surface outlet. Over 50% of Kenya's horticultural industry is located around the Lake. Its main catchment area is located in the Nyandarua and Kinangop Ranges (1,730km^2). The remaining fresh water discharge is through rainfall, ground water seepage and ephemeral streams; main contributor being the Gilgil river which drains the Bahati highlands (Kamau et al. 2013). The levels of endosulfan and its isomers in Lake Naivasha waters are reported in table 2

TABLE 9: Concentration (ng/L) of Endosulfan and Metabolites in Lake Naivasha

Sites	Endosulfan α-isomer	Endosulfan β-isomer	Endosulfan Sulfate	∑Endosulfan	Mean ± Std dev
S1	23.0±2.3	41.7±2.4	16.2±1.2	80.9	26.9±13.2
S2	20.1±2.1	44.2±3.1	78.4±4.3	142.7	47.7±29.3

S3	46.1±3.4	51.1±4.3	133.0±4.2	230.2	76.7±48.8
S4	57.9±4.5	92.8±5.1	195.5±9.2	346.2	115.4±71.5
S5	21.2±1.9	84.3±6.5	60.2±3.2	166.7	55.2±31.8
S6	*42.9*±3.1	*61.9*±5.5	*345.2*±6.7	*450*	*150*±169.3

Source: Njogu et al. (2011). (n=6)

Werimo and coworkers (2009) reported having detected less than 0.5 μg L^{-1} of β-Endosulfan in Lake Victoria waters at Ndere Island, the reported levels were low and posed no unacceptable risks from endosulfan contamination.

A number of rivers in Kenya drain into the sea, river Umba is the only Transboundary River its catchment area covers some section of Tanzania. River Ramisi is a costal river with a catchment spanning within the coastal region. Rivers Tana and Sabaki are the two major rivers the catchment areas drain through agricultural and urban areas. Table 3 reports on pesticide concentrations in seaweed and marine sediment, the reported endosulfan concentration was higher compared to the other pesticides analyzed.

TABLE 10: Mean concentration of organochlorine pesticides in sediments and seaweed.

Site/Sample	**Pesticide conc. (g/g)**
English Point	
Marine sediment-BHC	0.004±2.1
Nyali Bridge	
Marine sediment-BHC	0.025±0.01
Marine sediment-Endosulfan	**0.322±0.01**
Port Reitz Creek	
Sargassum-BHC	0.193±0.01
Makupa Creek	0.045±0.01
Thalasadendron-BHC	

Source: Oyugi et al. 2008

Table 13 reports on POPs detected in estuarine and marine environment of interest is to note that both Sabaki and Ramisi estuaries recorded the lowest α-endosulfan water concentrations, an indication of less use in their catchment area (Table 4). Kilifi and Mombasa on the other hand recorded high levels, the high levels in Kilifi can be attributed to the Goshi River, which flows through Taita Hills and enters the Indian Ocean at Kilifi Creek. This might imply high use of endosulfan in the catchment area of Taita Hills.

TABLE 11: Endosulfan and Lindane residues detected in water samples at different sites

Sites	**Mean (residues in water (ng/ml±sd)**			
	Sabaki	**Kilifi**	**Mombasa**	**Ramisi**

Lindane	0.241*	0.503±0.361	BDL	BDL
~-Endosulfan	**0.166±0.015**	**0.239±0.142**	**0.397±0.223**	**0.155±0.057**

**detected in one sample only; sd: Standard deviation; BDL: Below detection limit*
Source Wandiga et al. 2002

Fish sampled from the Tana estuary contained very low endosulfan levels, these samples were however sampled five years earlier, whereas the others were sampled in 2008 these were sampled in 2003. Possible cause of the variant could be that endosulfan use in the catchment area might have been low in the period prior 2003. The fish sampled from Sabaki estuary contained twice as much endosulfan concentrations compared to the other sites sampled (Table 12).

TABLE 12: Mean POPs concentrations («g Kg^{-1})in fish sampled in 2008 and 2003

Sites	Endosulfan	Lindane
Sabaki[a]	**40.2**	61.2
Kilifi[a]	**22.9**	26.5
Mombasa[a]	**12.0**	57.3
Ramisi[a]	**10.4**	281
Tana[b]	**<0.042**	131.2

Sources: *[a]Barasa et al (2008) , [b]Lalah et al. (2003)*

2.6.4 Production, use, import export in Kenya

In Kenya, endosulfan has been widely used as a broad based insecticide against agricultural pests namely, the cotton ball-borer and maize stalk-borer. From 2006 to 2010, 17,480 tons of endolsulfan was imported in the country. (PCPB)
Endosulfan and its isomers were banned for use in Kenya in 2011, following the approval of the Stockholm Convention committee for elimination of production and use and its isomers by all Parties. Kenya has not registered any exemptions at any COP meeting.

2.7 Status of the New Pesticide POPs in Kenya

TABLE 13: Status of the New Pesticide POPs in Kenya

New pesticide POPs	History background	Current status	Projected future production	Use	Import/export
Alphahexachlorocyclohexane	By product of lindane	banned	none	Used as insecticide	Have not been used in Kenya

Betahexachlorocyclohexane	By product of lindane	banned	none	Used as insecticide	Have not been used in Kenya
Lindane	Was Restricted for seed dressing only but is now banned 2011 but exempted for pharmaceuticals	Banned for agricult use only	none	Insecticide-Banned for agric use	Banned 2011
Chlordecone	Organochlorine related to mirex	banned	none	none	No export/import
Technical endosulfan and related isomers	Used as insecticide for control of tsetse fly and various crops	Banned 2011	none	none	No export/import

Kenya has not registered any specific exemptions for use and/or production

2.8 Obligations under the Stockholm Convention for the new pesticide POPs

In compliance with the Convention, Parties for which the new POPs have entered into force must therefore implement measures to reduce or eliminate production, uses and releases of the new POPs as called for in the Convention (**Articles 3, 5, 6**), and report these efforts to the Secretariat.

As part of NIP review and update, Parties should also evaluate the efficacy of the adopted action plans, strategy and measures included in their first or last updated NIPs.

The updated NIP should include the action plans to eliminate or restrict newly listed chemicals in accordance with the objective of the Stockholm Convention. In order to prioritize and decide on the national action plans for reducing and phasing out of the new POPs, it is important to identify the use/production, import/export/, and stockpile/waste of new POPs within the country, establish inventories, undertake assessment on socio-economic impact as well as environmental and health implications

2.9 Assessment of New Pesticide POPs

The introduction of the new pesticides to the POPs list in 2009 and 2011 adds to the amounts of obsolete stocks targeted for elimination

- The Convention requires that these chemicals (obsolete) be disposed of in an environmentally sound manner
- Obsolete pesticides and contaminated materials can pose a direct threat to public health and the environment.
- FAO has developed comprehensive set of training modules that link to key aspects of the management of pesticides including – the inventory of stocks, monitoring and evaluation etc.

2.10 Inventories of The New Pesticide POPs

Once amendments to Annexes A, B or C of the Convention adding new POPs enter into force, Parties are required to develop inventories for those substances so that information at the country level becomes available. This task is similar to the one for other substances during the initial NIP process.
Specific activities include: the development of a preliminary inventory on production, distribution, use, import and export; an inventory of stocks and contaminated sites and products; evaluation of management options for obsolete stocks; and an inventory of releases to the environment. Participation of key stakeholders is crucial to help ensure that necessary information is made available; and further to strengthen the reliability of the results.

Objectives
The objectives of the inventory were to:

- identify the presence (production, use, etc.) of the new POPs within the country,
- presence and location of stockpiles, wastes and of contaminated sites and then
- Prioritize which ones need a national inventory.

3.0 METHODOLOGY

Pesticide POPs task team was constituted which comprised consultant, resource and assistants personnel drawn from Pesticide Control Products Board, Ministry of Health, Government Chemists, Research Institutes (ICIPE) and Universities.

The task team consulted with the coordinator before and during the inventory phase to enhance inventory logistics, identifying stakeholders and training.
The inventory involved:

i) Desktop **r**eview of data available in the country imports, use, storage locations, private sector sales data, management practices, historical reports etc.
ii) Identification of stakeholders
iii) Field visits/site inspection of storage, use, stockpiles or wastes, location, quantity, source etc. This required staff with training on inventory taking and aware of the hazards associated with it. Training and the necessary information was availed before the commencement of field visits
iv) Questionnaires to survey pesticide stocks were used.

FAO data collection instrument/tool developed for inventory was adopted.

TABLE 14: Areas and sites that were visited

REGION/COUNTY	SITES VISITED
NAIROBI	**KFA, Twiga, Nairobi City Council- Dept of Public H. KARI, E.A. Seed Co., MoH, Few Agro-chemical shops.**
COAST	**NEMA, Kenya Ports** Authority, **SGS Kenya Ltd, KEMFRI, Kenya Revenue Authority, KEMRI KARI IN MTWAPA**
NAIVASHA SUBCOUNTY	**Bata Shoe Company, Limuru** **Public Health Offices, Oserian Flowers Farm**

and **NAKURU MUNICIPALITY:**	**Nakuru County Environment Office- NEMA** **Nakuru Provincial Hospital,** **Kenya Farmers Association, Gioto Solid waste Dumping** **Kenya Seed Company**
WESTERN/NYANZA	**NEMA- Kisumu, Maseno University** **Kemri**
RIFT VALLEY	**NEMA-Eldoret, KARI-Kitale, Kenya Seed- Kitale**

4.0 RESULTS OF THE INVENTORY

The summary of the results obtained in each area are as indicated in the table below (Some of the detailed reports and the persons involved are given in the annex)

TABLE 15: Areas visited and outcome

REGION/COUNTY	
NAIROBI	**Report**
KFA, Twiga, KARI, E.A. Seed Co., Few Agro-chemical shops	The information obtained from the PCPB inspection records indicated that there are no pesticide POPs from all these areas
COAST COUNTY	
NEMA,	Not directly involved with POPs but are involved in reinforcing the regulations of solid waste.
Kenya Ports Authority	Deals with all kinds of chemical products leaving or entering the ports
SGS Kenya Ltd,	The lab has facilities and capacity to analyze most of the POPs.
KEMFRI,	The contact person was not available the day visited. Institute deals with research in fisheries, aquaculture, ecology and environment etc.

Kenya Revenue Authority,	Importation of POPs into the country with regard to the types of chemicals and quantities. Not aware of the obligations of the Stockholm convention. Noted the need to update the list of prohibited chemicals
KEMRI	Main research on alternatives to DDT in vector control/ malaria control. DDT restricted for use in Public Health.
KARI IN MTWAPA	Activities: livestock, tree nursery, crop and commercial farming. Emphasis mainly on good agricultural practice.
NAIVASHA SUBCOUNTY	
& **NAKURU MUNICIPALITY**	
Public Health Offices, Oserian Flowers Farm Nakuru County Environment Office- NEMA Nakuru Provincial Hospital, Kenya Farmers Association, Gioto Solid waste Dumping Kenya Seed Company	No pesticide POPs were reported in any of the areas visited But the only information was from the **Kenya Seed Co.** • Enquired whether any of the POPs is still in their stocks • Aware of only Lindane which was recalled from all branches and stored in Nakuru branch. • Currently 22 drums of 200 liters each stored in the facility and is used for seed dressing in wheat. The supplier, BUYER informed - that was the last consignment and import of lindane. • As for endosufan, she was not sure because of the trade name(to check with PCPB)
RIFT VALLEY NEMA- Eldoret	Not aware of Kenyan NIP 2007. Dealing mainly with ODS, and therefore needed to know the background information To be involved implementation.challenge of pollution related to credibility of results in a code of law' Transbounary movement of chemical- lindane and furadan being sold in Uganda No accredited lab. Samples sent to other labs e.g. SGS Danger of disposal of chemicals in to latrines Capacity required lab and surveillance, protocol to reporting?

KARI- Kitale	Had been using lindane for seed dressing until it was unavailable. Then purchased lindane/thiram in small sachets which was very toxic. Now using Marshal 350 STD which seems to be less toxic. No effective protective gear. Staff not aware of Kenya NIP 2007. Problem with obsolete chemical disposal Had expired lab chemicals in the store and other expired pesticides not POPs awaiting disposal.
Kenya Seed- Kitale	➢ Lindane no longer used for seed dressing ➢ Alternatives already registered – imidacloprid, ➢ Few expired stocks in store requiring disposal
Maseno University	Collaboration of research activities highlited and discussed Challenges: POPs residues still in our environment
WESTERN/NYANZA NEMA – Kisumu	• Municipal waste – a health hazard • Illegal trade, influx of chemicals across the border • Environmental monitoring research required
KEMRI	For pesticide POPs alternatives e.g. Bendiocarb compared with pyrethroids suitable alternative for mosquito vectors which are resistant to pyrethroids

The Table below gives a summary of information of the situation of New Pesticides POPs, stock piles, obsolete/ wastes and contaminated sites gathered during the site visits and indicates the remedial measures that need to be undertaken

TABLE 16: Stockpiles, contaminated sites and wastes

New pops	Contaminated sites	wastes	Quantity	Relevant regulations	Guidance/remedial measures
Alpha hexachlorocyclohexane	none	N/A	N/A	PCPA	Environmental monitoring
Beta hexachlorocyclohexane	none	N/A	N/A	,,	,,
Lindane	none		N/A	,,	,,
Chlordecone	none	N/A	N/A	,,	,,
Technical endosulfan and related isomers	none	N/A	N/A	,,	,,

Detailed information of the situation of New Pesticides POPs, stock piles, obsolete/ wastes and contaminated sites were gathered during the site visits.

4.1 Key Observations Noted:

- No stockpiles or obsolete pesticide P0Ps reported in all the areas visited except for a few expired chemicals not necessarily POPs that were reported in two sites.
- Some chemical stores require better organization
- No registers kept for expired chemicals and some had no labels
- Some workers reported getting sick after spraying certain chemicals
- Lack of adequate facilities for proper identification of POPs
- Labs not properly equipped and capacity to do some analysis lacking
- Lack of understanding of some stakeholders e.g those holding obsolete POPs – detailed required information not given
- There was concern that there is a possibility of some banned chemicals entering the country from the neighboring countries and repackaged
- Some of the banned pesticides formulated with others(not POPs) and sold to non suspecting farmers
- Time and resources not enough for a comprehensive inventory

4.2 Recommendations

- PCPB to disseminate information with regard to new or banned pesticides to all stakeholders
- Monitoring programme should be carried out periodically in order to note the trend of these chemicals in the environment
- Need to enforce surveillance of regulated chemicals across the borders.
- PCPB and NEMA to take the initiative on informing stakeholders the best way of disposal of expired chemicals
- Epidemiological studies should be carried out once a new chemical is in use in the country
- Funds for research should be sought and labs facilitate for monitoring. on safe use
- Continued training on all those handling pesticide from the port to the farm users
- Need to develop practical and affordable as well as implementable practices for protection of workers, environment and communities from the adverse health effects of pesticide in the environment
- Need to develop and build institutional capacity to manage obsolete pesticides in order to avoid accumulation
- Need for adequate facilities and trained staff for proper monitoring of POPs
- Collaboration between laboratories both local and international should be initiated with a view to strengthen the national capacity to monitor pesticide POPs in both manpower and equipment.

4.4 CONCLUSION

In conclusion there were no stockpiles, contaminated sites and wastes reported in all the areas visited except in Nakuru where lindane (last stock) for seed dressing was reported. However there is need to crry out monitoring studies with regard to residues in the environment especially in agricultural premises and farms where lindane and endolsulfan has been used.

There is need to have a mechanism of distributing the NIPs to all stakeholders or make the information public, maybe have a chemical website and occasionally reviewed.

Noted: Except for the institutions involved in implementation of the Stockholm Convention the majority of other stakeholders and the public at large are not aware of Kenya NIP 2007.

SUMMARY

4.5 ACTION THAT NEED TO BE TAKEN

i) There is need to compile all what has been undertaken in different institution as measures taken to comply to the Stockholm Convention. This requires coordination of all stakeholders.

ii) Review continuing activities and support the institutions where need be.

iii) Capacity building efforts under, sampling and analytical methods for addressing the newly listed POPs and other priority chemicals

iv) Monitoring programmes should be implemented, supported and results published after every 2-4 years

v) Border surveillance should be enhanced

vi) Educating the communities on proper handling/use /disposal of obsolete chemicals should be a continuous process, since new products and technologies keep coming up.

vii) Alternatives to DDT and other POPs should be compiled, with full reports on their effectiveness. Any emergence of vector resistant should be reported , specific areas noted and recommended alternatives indicated

viii) Establish a data base centre or website for information to all and about pesticide POPs in Kenya

5.0 ALTERNATIVES AND SUBSTITUTES DDT

5.1 Assessment of Annex B Chemicals (DDT)

5.1.1 Historical Use of DDT

DDT was used as a wide spectrum insecticide in agriculture, livestock rearing and malaria vector control. It was first used in the control of highland malaria in 1947. The product was banned for use in livestock rearing and agriculture in 1976 and 1986 respectively. It was further restricted for use in disease vector control in the same year (1986) but has not been used in vector control activities since.
In September 2006 the Ministry of Health issued a statement on the fact that it was not the policy of the Ministry to reintroduce DDT.

DDT, and its break-down products DDE and DDD, are persistent, bio-accumulative, and toxic (pollutants targeted for elimination. Harmful effects of DDT include being probable human carcinogen, damages the liver, temporarily damages the nervous system, reduces reproductive success, can cause liver cancer and damages reproductive system among others. Exposure to DDT occurs by eating contaminated fish and shellfish, breast milk, eating food directly exposed to DDT and eating crops grown in DDT contaminated soil. Potential Sources to the environment include DDT in soil absorbed by some growing plants and by the animals or people who eat those plants, DDT in water absorbed by fish and shellfish in those waterways, atmospheric deposition, soil and sediment runoff, and improper use and disposal.

The first POPs inventory done in 2006 indicated that most of the residual DDT was held by the Kenya Farmers Association in Nairobi, the Rift Valley and Central Provinces. The total amount of obsolete DDT identified nationwide was then 1,338 kg. which has now been disposed off together with other wastes (PCPB)
In 2012 the DDT expert group under Stockholm Convention, having recognized the continued need for DDT for disease vector control, recommended, among other things, that the use of DDT in indoor residual spray should be limited only to the most appropriate situations based on operational feasibility, epidemiological impact of disease transmission, entomological data and insecticide resistance management. It also recommended that countries should undertake further research on and implementation of non-chemical methods and strategies for disease vector control to supplement a reduced reliance on DDT.
Kenya has continued to indicate a strong commitment to developing alternatives to DDT.
The first NIP recommended activities that would target the further development and commercial roll-out of alternative disease vector control strategies that avoid the use of DDT. Since then, several alternatives have been initiated, chief among them being the use chemical alternatives, plant-based alternatives and Intergrated Vector Management (IVM) practices.

5.2 Chemical Alternatives to DDT and Endolsufan

The POPRC, WHO and DDT expert group have recognized the need for continued use of DDT until a suitable alternative is obtained. A list of alternative chemicals for DDT and endosulfan was presented . Currently, 11 chemicals have been suggested as potential alternatives for DDT and 110 chemicals as alternatives for endosulfan. The alternatives are

evaluated for efficacy, persistence and POPs like properties. DDT alternatives include: Bifenthrin, chlorpyrifos, deltermethrin, fenitrothion, malathion, etc.

For evaluation purpose, POPRC has categorized DDT alternative chemicals into 3 classes:

- Class 1:- Substances that the committee considered to have met all annex D criteria- (No substance has met all the annex D[1] criteria)
- Class 2- substances that the committee considered might meet all Annex D criteria but remained undetermined due to equivocal or insufficient data: Bifenthrin
- Class 3: substances that the committee considered not likely to fulfil the criteria in Annex D (Alpha-cypermethrin, bendiocarb, cyfluthrin, lambda-cyhalothrin, deltamethrin, etofenprox, fenitrothion, malathion, pirimiphos-methyl and propoxur).

TABLE 17: shows the chemical alternatives that have been identified by POPRC as chemical alternatives to DDT

No.	Insecticide	Group	DDT alternative
1.	Alpha-Cypermethrin	Pyrethroid	x
2.	Bendiocarb	Carbamate	x
3.	Bifenthrin	Pyrethroid	x
4.	Cyfluthrin	Pyrethroid	x
5.	Lambda-cyhalothrin	Pyrethroid	x
6.	Deltamethrin	Pyrethroid	x
7.	Etofenprox	Pyrethroid	x
8.	Fenitrothion	Organophosphate	x
9.	Malathion	Organophosphate	x
10.	Primiphos-methyl	Organophosphate	x
11.	Propoxur	Carbamate	x

[1] Annex D covers social economic considerations

5.2.1 Chemical Alternatives to DDT in use in Kenya

The Kenya Medical Research Institute that has been monitoring the resistance of major malaria vectors to the insecticides used for indoor residual spraying and in bed nets reported high levels of resistance to pyrethroids, used for malaria control in Kenya, and recommended that Bendiocarb which belongs to the carbamate class of insecticides be used for IRS .

Bendiocarb is highly effective against resistant mosquito populations and its mode of action is different from pyrethroids.. The mode of action of bendiocarb compared with pyrethroids makes this insecticide a suitable alternative for mosquito vectors which are resistant to pyrethroids. Community acceptability was high at 95% as evidenced in the study conducted in western Kenya in 2011 (Mbogo 2013 communication) However there are other factors that make it less favourable compared to pyrethroids. It is less persistent which makes it more expensive compared to pyrethroids and slightly higher toxic thus require more stringent measures for environmental protection and human safety (ref)

However, studies should continue to identify more compounds of insecticides to make up a pool of efficacious insecticides to be considered for alternate and rotational use as part of resistance management.
A good monitoring plan for vector resistance to different classes of insecticides is necessary in our settings and, more specifically, in areas with a high level of agricultural pesticide use

5.3 Non- Chemical Alternatives to DDT

5.3 1 Biopesticides in Kenya

Biopesticides are derived from micro-organisms (bacteria, fungi, viruses, etc), plants (neem, pyrethrum, etc) and natural enemies of pests (parasitoids, predators and pathogens). Also included under biopesticides are semiochemicals (e.g. insect sex pheromes), enzymes (proteins) and natural plant regulators and insect growth regulators. Table 1 and Table 2 depict biocontrol agents (products derived from micro-organisms and natural enemies) and botanical pesticides (derived from plants), respectively. These biopesticides are registered in Kenya by the Pesticide Control Products Board (www.pcpb.or.ke).

5.3.2 Plant-based pesticides available in Kenya

Trade names of products Active substances of products Target pest/disease Agent / distributor are all given in the Annex 5 and a list of Biopesticides (biocontrol agents) available in Kenya (PCPB register 2013)

5.4 Integrated Vector Management (IVM)

The Ministry of Public Health and Sanitation through the Division of Malaria Control, has been committed to achieving the targets of Roll Back Malaria initiative, the Abuja Declaration, and the Millennium Development Goals through the Economic Recovery Strategy and scaling-up of effective interventions. This commitment was expressed through the National Health Sector Strategic Plan (2008-2012) and the National Malaria Strategy (2009-2017). The goal of the new National Malaria Strategy is to reduce morbidity and

mortality caused by malaria by two thirds of the baseline in 2007/2008 among the Kenyan population by the year 2017

Since the development of the last NIP, various integrated vector management (IVM) programmes were initiated in Kenya particularly for the control of malaria as an alternative to the use of DDT. IVM is a rational decision-making process for the optimal use of resources for vector control. It includes five key elements: evidence-based decision-making; integrated approaches; collaboration within the health sector and with other sectors; advocacy, social mobilization, and legislation; and capacity-building. Some of the IVM approaches include the use of insecticide-treated nets (ITN), proper use of mosquito nets and environmental management for malaria vector control, including draining, filling and covering of mosquito larval habitats, use of bio-larvicides and mosquito proofing of houses. In 2004, the WHO adopted IVM globally for the control of all vector-borne diseases. IVM initiatives have been initiated in Kenya by various institutions including the Ministry of Health, research institutions and Universities and the Stockholm Regional Centre in Kenya based at the International Centre of Insect Physiology and Ecology (*icipe*).

5.5 Assessment of Stockholm Convention Regional Centre in Kenya

The following functions are reported:

- Its role in promotion of non-chemical alternatives through technical assistance and capacity building programmes with emphasis on various activities that has been carried out, which includes:

- Regional workshops and training activities

The International Centre of Insect Physiology and Ecology (*icipe*) was nominated by the Africa region to serve as a Stockholm Convention regional centre in July 2010. It was endorsed in 2011 as a regional or sub-regional centre for capacity building and the transfer of technology by COP 5 for four years. In particular, the regional centre focusses on capacity building and transfer of technology in alternatives to the use of persistence organic pollutants (POPs) in management of disease vectors and pests. It maintains strong collaboration with the Stockholm Convention focal point in Kenya.

icipe is an international organization established in 1970. It undertakes research, capacity building, institutional development and technology transfer in alternative eco-friendly methods for control of disease vectors and crop pests, and for commercial insects production. The alternative technologies contribute to reduction in the use of persistent organic pollutants (POPs) in vector and pest control in Africa.

5.6 Alternatives to POPs for human disease vector control

ICIPE undertakes research, capacity building, institutional development and technology transfer in alternative eco-friendly methods for control of vectors of tropical diseases without the use of persistent organic pollutants (POPs), particularly DDT for malaria control. These are implemented as part of integrated vector management (IVM) strategies. The following are some of the activities that have been undertaken:

- **Regional workshops**: With financial assistance from the Stockholm Convention Sectretariat, UNEP and GEF, *icipe* has worked with partners and stakeholders to conduct a series of regional workshops for strengthening in-country capacities to implement integrated vector management (IVM) as an alternative to DDT conducted for 8 African countries in eastern and southern Africa during 2010–2012.
- **Training of Community Resource Persons (CORPs) in IVM:** Over 200 Community Resource Persons (CORPs) have been trained to lead communities in IVM in Kenya and Ethiopia.
- **Training of community members in IVM:** Over 200,000 community members in Kenya and Ethiopia have been trained in the following: proper use of mosquito nets and environmental management for malaria vector control, including draining, filling and covering of mosquito larval habitats, and mosquito proofing of houses.
- **Training of children in IVM:** More than 9,000 children have been trained in IVM in Kenya and Ethiopia through school clubs and drama
- Promotion of use of eco-friendly biopesticides for control of mosquito larvae in Kenya and Ethiopia, including the *Bacillus thuringiensis (Bt)* bacterium and plant-based products.
- **Malaria prevalence:** As a result of these interventions, malaria prevalence reduced from 50 to 4% by use of mosquito nets and environmental management in coastal Kenya.

5.7 Alternatives to POPs for pest control

Research and development by *icipe* in alternative eco-friendly methods for control of crop pests has led to a number of effective alternative technologies that are contributing to reduction in the use of persistent organic pollutants (POPs) in Africa. Through capacity building and technology transfer they are being promoted for use in Africa in various integrated pest management (IPM) strategies. The following are examples:

- **Push–pull' habitat management strategy:** This is an intercropping technology for control of cereal stemborer pests and striga weed, improvement of soil fertility and increased production of fodder. The technology has been adopted by over 50,000 farmers in Eastern Africa with significant increases in crop yield. This has led to a significant reduction in the use of synthetic pesticides and herbicides;
- ***Metarhizium anisopliae*-based biopesticides:** Two biopesticides have been developed from two fungal isolates (ICIPE 69 and ICIPE 78), registered and commercialised in Ghana, Ethiopia, Kenya and South Africa through Public–Private Partnership. Campaign® is used for control of mealybugs, thrips and fruit flies while Achieve® is used for control of mites on various crops.
- **Fruit fly IPM**: icipe has developed IPM strategies for fruitflies consisting of the following: population monitoring, protein bait, male annihilation, field sanitation, and biological control (using biopesticides, parasitoids and weaver ants). Over 5000 mango and citrus growers in Benin, Cameroon, Kenya, Mozambique and Tanzania are using the IPM methods. As a result, of the strategy, rejection of mango fruit by export markets reduced from 37% in 2003 to 4% in 2011 among farmers in Kenya.
- **Diamondback moth biological control**: Biological control of the diamondback moth has been achieved through release of a parasitoid wasp, *Diadegma semiclausum* from Taiwan in Kenya, Ethiopia, Tanzania and Cameroon. As a result, a gross margin from production

of crucifer was enhanced by 81 percent due to mitigation of pest damage and reduction in insecticide sprays by 75 percent. Benefit–cost ratio for the investment in research is estimated at 24:1 over 25 years in Kenya alone.

5.8 Alternatives to POPs for animal disease vector control

ICIPE has been undertaking research, capacity building and technology transfer in eco-friendly methods for control of livestock pests in Africa to replace the use of persistent organic pollutants (POPs). Tsetse flies are deadly bloodsucking flies found only on the African continent, which carry the trypanosome parasite that causes human African trypanosomosis (HAT) (commonly called sleeping sickness). In cattle the disease is called nagana or animal African trypanosomosis (AAT). On the other hand, ticks transmit a number of important livestock diseases, including East Coast fever.

- **Odour-baited traps for control of tsetse flies:** *icipe* has developed eco-friendly traps which attract tsetse flies that are based on shape, colour and volatile odour baits, including cattle urine and acetone, the latter present in the breath of cattle. The traps have been used successfully all over Africa for control of savanna species of tsetse, thereby eliminating the use of synthetic pesticides.
- **Repellent collars for control of tsetse flies:** Repellent collars have been developed, using repellent compounds identified from wild animals like the waterbuck that are naturally avoided by tsetse flies. The repellent tsetse fly collars, when fitted around the neck of cattle, protect the herd and herdsmen from tsetse and other biting flies. This 'mobile' technology is specially suited for pastoralists, but is also increasingly popular with the sedentary coastal communities in Kenya. Nagana disease incidence in cattle and drug use reduced by more than 90%. As a result, farmers are able to graze their animals anywhere, including in tsetse-infested areas.
- **Entomopathogenic fungi (EPF) for control of ticks:** A biological control strategy was developed that can improve the livestock industry, for use in conjunction with conventional approaches like acaricides to manage ticks in smallholder farming systems, consists of fungal pathogens. Bioprospecting for tick fungal pathogens was carried out in Kericho and Nguruman in Kenya. Twelve fungal isolates were isolated and are stored in *icipe*'s Arthropod Germplasm Centre.

Chemical alternatives to POPs are being addressed in collaboration with the following organizations: Ministry of health, Ministry of agriculture, Ministry of Environment, Kenya Agricultural Research Institute, Universities, Research organizations; CIAT-international, the private sector such as Real IPM, and institutions promoting organic farming.

The following were identified as priorities with regard to updating the NIP:

i) Need to outline the technical assistance received from UNEP Secretariat and Assistance from GEF
ii) Outline the trainings held and workshops- this can be provided as link to the web resources or a reference to the published documents
iii) Strategic plan for the Centre
iv) Collaboration activities with the POPs Focal Point
v) Policy Commitment agreed at the Board to accept it as regional Centre

vi) Project concepts
vii) Collaboration with KEMRI, KARI etc.
viii) Activities on alternative of POPs other than DDTs

In addition, the following were identified as additional activities that the ICIPE Regional Centre could get involved in:

a) Partnering with other organizations and Ministry of Health e.g. UNEP and WHO seeking to help the country to work with IVM-
b) Collaboration with PCPB to promote the use of bio-pesticides
c) Developing joint projects to in the area of alternatives especially in the Eastern Africa Region.
d) Interrogating COP decisions e.g. COP 6, and developing projects for resource mobilization to address the proposed activities- technical assistance, ,
e) Seek financial resources from TRUST funds-as part of resource mobilization.
f) Set up a unit for MEAs at ICIPE to facilitate continuity and sustainability of activities.

It was noted that ICIPE has some of her consultants based at KEMRI. Recently, ICIPE has received some support to help implement IVM in selected countries in Africa.

5.9 Challenges and needs

- There is a need for technical, financial and other assistance to enhance research, development and application of locally appropriate, cost effective and safe alternatives to the use of DDT.
- There is a need for appropriate and enabling policy and regulatory framework, and appropriate mechanisms to enhance adaptation of alternatives technologies to the use of DDT.
- Funding should be made available to support transition away from the reliance on DDT for disease vector control, with the highest priority to assure that adequate systems and institutional capacity are in place to train and support skilled staff for entomological monitoring, operational research, evidence-based decision-making and to monitor programme performance.
- Funding should be made available to increase the national policy and management capacity for translating international best practices (BEP and BATS) on disease vector control and implementing quality assurance systems to assess programme performance and impact.
- Testing of other WHO Pesticide Evaluation Scheme (WHOPES) approved non-pyrethroids insecticides is necessary to increase the number of candidate insecticides for future selection and application for IRS in the country
- There is a need for strengthening the Stockholm Regional Centre in Kenya for capacity building and transfer of technology to the parties.
- Need for continued monitoring of POPs in the environment, implementation of the alternative strategies, benchmarking, feedback and coordination mechanisms and impact of the plan.

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ANNEXES

Annex 1 Action Taken As Per Nip 2007

\	Objectives	Activities	Responsibility	Action Taken
1	Capacity building to communities to dispose exiting stocks	-Conduct stakeholders Workshops, investment projects, consultative meeting for target communities and	NEMA, PCPB, KARI, Ministry of Agriculture, AAK, KEPHIS, KIRDI, KETRI and Consultants KNCPC,	Trained 4 PCPB pesticide inspectors, 2 lab analysts from PCPB. 2 currently post graduate diploma in pesticide management. Capacity building to PCPB stakeholders (farmers, stockist and distributors). The other institutions have carried other activities within their mandates.
2	Building inspection capability for POPs to ensure compliance	- Verify DDT sites - Remediate DDT contaminated sites. - Quantify and Mark known sites - Mark Hot spots - Document Status - Clean-up 100% of sites - Promote adoption of BAT/BEP in disposal and transportation methods	MOD, NEMA, PCPB, KARI, Ministry KEPHIS, KIRDI, KETRI and Consultants, KEBS	PCPB carried out further awareness on contaminated sites • Soil samples collected for analysis • Menengai site has self- reclaimed • Collected and disposed 100 tonnes of composite pesticides • Collection of obsolete pesticide ongoing in Mt. Kenya region. • Enforcement of disposal regulation by PCPB, NEMA, County Governments
3	Strengthen existing analytical laboratories to assess low POPs content	Provide equipment – Train staff and lead agencies -Develop common monitoring - Access to GMP identification and strengthening of existing	KARI, KEPHIS, KIRDI, KETRI and Consultants GC, KEBS GOVERNMENT CHEMIST , UNVERSITIES.	• Capacity building and training of personnel at University of Nairobi, chemistry Dept. • Provision of consumer items and small scale analytical item to

		laboratories having trained personnel that can coordinate and initiate collaborative studies and analyses and train others;		UoN.
4	Support to private analytical laboratories to undertake the same	Provide support to University and referral laboratories Registered in line with EMCA	NEMA, PCPB, KARI, Ministry of Agriculture, AAK, KEPHIS, KIRDI, KETRI and Consultants, KEBS AND KIRDI	
	Monitoring Program	Carry out surveillance of contamination of Lake Victoria ,	Fisheries Department KEFRI, NEMA/GCD/UON? KEMRI	• Global Monitoring Programme by UoN • Through LVEMP the Govt is addressing waste management, sewage work for the catchment, pollution control on rivers flowing to the lake • Global monitoring
	Research, Development And Monitoring	Identify research activities on POP	NEMA, PCPB, AAK KARI, KEPHIS	Research on non chemical alternatives by KEMRI, ICIPE,Real IPM in Thika, Dudutech in Naivasha and Timau Research on general pesticide traces around Lake Naivasha PCPB
	Legal/policy /regulations	Need to harmonize the legislation regulating chemicals use Amend current laws to avoid duplication or conflicts in the law.	NEMA, PCPB, KARI, Ministry of Agriculture, AAK, KEPHIS, KIRDI, KETRI and Consultants KNCPC,	NEMA Draft chemical policy developed,MEMR (Quick Start Programme) Draft Chemical Regulations Developed, NEMA Banning of listed pesticides,PCPB Disposal regulations developed by PCPB, NEMA, County Governments. Regulation for Procedures for registration of Biopesticides developed by PCPB, Draft IVM policy Guidelines for licencing of incinerators developed by
	Enforcement of law and	Intensification of border surveillance involving all		Licensing of Incinerators by PCPB

	regulation	relevant government agencies		and NEMA

Article 15: Reporting

1. Each Party shall report to the Conference of the Parties on the measures it has taken to implement the provisions of this Convention and on the effectiveness of such measures in meeting the objectives of the Convention.
2. Each Party shall provide to the Secretariat:
   (a) Statistical data on its total quantities of production, import and export of each of the chemicals listed in Annex A and Annex B or a reasonable estimate of such data; and
   (b) To the extent practicable, a list of the States from which it has imported each such substance and the States to which it has exported each such substance.
3. Such reporting shall be at periodic intervals and in a format to be decided by the Conference of the Parties at its first meeting.

Kenya reports under Article 15 in the format and at intervals decided by the Conference of the Parties. In accordance with its obligations, Kenya submitted its first National Report on , 2007, but Kenya 's second National Report, is addressing the obligations for the new pesticide POPs, hopefully to be reported by April 2014.

Article 3 of the Convention obligates Parties to prohibit and/or take the legal and administrative measures necessary to eliminate the production, use, import and export of POPs that are listed in Annex A of the Convention. It also obligates Parties to restrict the production, use, import and export of chemicals listed in Annex B. Annexes A and B include exemptions for use and/or production and articles in use

Alpha-HCH, Beta-HCH and Chlordecone and Pentachlorobenzene The PCPB has is no registered uses for these POPs; therefore, their production, use or sale in Kenya as pesticides does not apply. Since there are no uses of these POPs other than their historical use as pesticides, no additional measures other than those applied through the PCPB are required for Kenya to meet its obligations under the Stockholm Convention for elimination of the production and use of these POPs

The same applies **for lindane, endolsufan and all the initially listed pesticides POPs** which have been banned for use in Kenya as discussed earlier.

However monitoring programmes should be implemented as a priority to follow the trends of these chemicals in the environments and evaluate the effectiveness of the measures taken.

Annex 2: Action Plans for Pesticides POPS

Short and Long Term Activities

Objectives	Activities	Responsibility	Time line	Budget Ksh
Public awareness on current situation of pesticide POPs in the country and alternatives.	Workshop for all stakeholders and county reps - Compile all what has been undertaken in different institutions as measures taken to comply to the Stockholm Convention	NEMA, PCPB, KARI, AAK, MOH Stockholm Convention Region Centre	1	1M
To strengthen the national capacity and capability to perform chemical analysis and monitoring of POPs.	Invest and sustain resources both in human and financial terms – training, acquisition of equipment, transfer of technology etc.	MEW&NR, KARI, PCPB, KEPHIS, DGC, NEMA, Research Institutions Universities and Private Sector Partnership with donor countries.	3	500M
To fulfil the requirements of the Convention and other agreements	Collaborative studies and analyses among laboratories, both at national and international levels	All national laboratories especially those involved with POPs, universities and private sectors including donor partners	1	50M
Research, Development and implement Monitoring	Review continuing activities and support institutions results after every 2-4 years workshops/seminars	MEW&NR, Treasury, NEMA,Stockholm Region Centre Private sector, Universities	3	150M

programme	/training	Development Partners		
Generation of alternative products for all pesticide POPs	Continued research on IVM and BEP Promoting IVM / IPM programmes in Kenya.	NEMA, MoA MoH, KARI KEMRI,ICIPE	3	300M
Continuous monitoring and determine the distribution of All banned POPs in the environment;	Coordinated Collaborative studies and analyses among laboratories, both at local and national levels	All national laboratories, research institutions, universities and private sectors	1	100M
Enforcement of law and regulation	Border surveillance should be enhanced	involving all relevant government agencies	3	200M
TOTAL				**1,301 M**

Annex 3: Action Plans for DDT Alternatives

	Objectives	Activities	Responsibility	Time Frame Yrs	Budget Ksh
1	Update knowledge on extent of use of DDT alternatives	Identify the alternatives used especially in malaria prone areas effectiveness, social and health impacts	ICIPE KEMRI MOH MOPH&S, NEMA, PCPB PBK	1	5M
2	Development of strategies for management of alternatives to DDT and other	Identify alternatives to DDT and other Pesticide POPs Carry out institutional needs assessment	MOH ,MOPH&S, NEMA, WHO, UNEP ICIPE/ KEMRI, MOA PCPB	3	30M

	pesticide POPs	Carry out stakeholders analysis to determine financing requirements			
	To strengthen malaria control performance monitoring and evaluation system	Build partnerships Identify funding sources Enhance capacities at grassroots levels for sustainability Sensitize policy makers on the need for allocation of resources for alternatives	NEMA, MENR, WHO Treasury, KEMRI ,ICIPE, MOH, PBK MOPH&S	3	200M
	Strengthen and build capacity and sustainability	Collaboration within the health sector and with other sectors ministries and public and private sectors, sharing and optimizing the use of resources,	MOH, MOPH&S ,DOMC KEMRI, ICIPE , MOA MENR/NEMA	2	50M
	Capacity building for planning and , monitoring	Development of adequate human resources, training and career structures at national and local level to manage IVM programmes, development of essential physical infrastructure, provision of financial resources	MOH, MOPH&S ,DOMC KEMRI, ICIPE, NEMA, MENR MOL&F Universities Research institutions Private Sector	3	300M
	Strengthen research development and monitoring activities	Developement of appropriate monitoring tools s and a clear monitoring system incorporated into the program, with budgets allocated Monitoring on health and environmental impact Operational research in all areas/counties .	ICIPE, KEMRI, MOH MOPH&S, NEMA MOL&F Universities Research institutions -Private Sector	2	300M
	Information Exchange and creation of public awareness	Update of existing database Develop modalities for inform ation exchange programs.	NEMA, MOPH&S MOH, MOA, MOL&F Universities Research institutions -Private Sector	1	2M
	Policy and regulatory Framework	Harmonize the existing regulations and legislation Hold stakeholders consultative forum for alternatives to DDT	MENR, NEMA,MOH,WHO, UNEP, MOA KEMRI.	2	7M

	TOTAL				**894M**

Annex 4: Banned Pesticides in Kenya

	Common name	Use	Date Banned
1.	2,4,5 T (2,4,5 – Trichloro-phenoxybutyric acid)	Herbicide	1986
2.	Chlordane	Insecticide	1986
3.	Chlordimeform	Insecticide	1986
4.	DDT (Dichlorodiphenyl Trichloroethane)	Agriculture	1986
5.	Dibromochloropropane	Soil Fumigant	1986
6.	Endrin	Insecticide	1986
7.	Ethylene dibromide	Soil Fumigant	1986
8.	Heptachlor	Insecticide	1986
9.	Toxaphene (Camphechlor)	Insecticide	1986
10.	5 Isomers of Hexachlorocyclo-hexane (HCH)	Fungicide	1986
11.	Ethyl Parathion	Insecticide All formulations banned except for capsule suspensions	1988
12.	Methyl Parathion	Insecticide All formulations banned except for capsule suspensions	1988
13.	Captafol	Fungicide	1989
14.	Aldrin	Insecticide	2004
15.	Benomyl, Carbofuran, Thiram combinations	Dustable powder formulations containing a combination of Benomyl above 7%, Carbofuran above 10% and Thiram above 15%	2004
16.	Binapacryl	Miticide/Fumigant	2004
17.	Chlorobenzilate	Miticide	2004
18.	Dieldrin	Insecticide	2004
19.	Dinoseb and Dinoseb salts	Herbicide	2004
20.	DNOC and its salts (such as Ammonium Salt, Potassium salt & Sodium Salt)	Insecticide, Fungicide, Herbicide	2004
21.	Ethylene Dichloride	Fumigant	2004
22.	Ethylene Oxide	Fumigant	2004
23.	Fluoroacetamide	Rodenticide	2004
24.	Hexachlorobenzene (HCB)	Fungicide	2004
25.	Mercury Compounds	Fungicides, seed treatment	2004
26.	Pentachlorophenol	Herbicide	2004
	Phosphamidon	Insecticide, Soluble liquid formulations	2004

		of the substance that exceed 1000g active ingredient/L	
27.	Monocrotophos	Insecticide/Acaricide	2009
28.	All Tributylin Compounds	All compounds including tributyltin oxide, tributyltin benzoate, trybutyltin fluoride, trybutyltin lineoleate, tributyltin methacrylate, tributyltin naphthenate, tributylin chloride	2009
29.	Alachlor	Herbicide.	2011
30.	Aldicarb	Nematicide/Insecticide/Acaricide.	2011
	Endosulfan	Insecticide.	2011
31.	Lindane	Insecticide.	2011

Annex 5 Review of Dichlorodiphenyltrichloroethane by POPRC

1. The Stockholm Convention on POPs, under the guidance of the World Health Organization (WHO), allows the use of the insecticide dichlorodiphenyltrichloroethane (DDT) in disease vector control to protect public health. DDT is listed in Annex B of the Convention, which restricts its production and use except for parties that have notified the Secretariat of their intention to produce and/or use it for disease vector control.

2. During its ordinary meetings, the Conference of the Parties, in consultation with the World Health Organization evaluates the continued need for DDT for disease vector control on the basis of available scientific, technical, environmental and economic information.

3. By its decision SC-3/2, the Conference of the Parties adopted a process for the reporting on and assessment and evaluation of the continued need for DDT for disease vector control, in which a DDT expert group was established to undertake the assessment of related technical information and make recommendations to the Conference of the Parties to facilitate the evaluation.

4. Also by its decision SC-5/6, the Conference of the Parties decided to evaluate the continued need for DDT for disease vector control at its sixth meeting, on the basis of available information including that provided by the DDT expert group and the Persistent Organic Pollutants Review Committee (POPRC), with the objective of accelerating the identification and development of locally appropriate cost-effective and safe alternatives.

5. Furthermore, the Conference of the Parties requested the POPRC, beginning at its eighth Meeting, to assess the alternatives to DDT, in accordance with the general guidance on considerations related to alternatives and substitutes for listed persistent organic pollutants and candidate chemicals on the basis of factual information provided by parties and observers.

6. The DDT Expert Group has assessed the continued need for (DDT), and recognized its continued need in specific settings where safe alternatives are lacking. The Expert Group held its fourth meeting from 3-5 December 2012, in Geneva, Switzerland, and considered issues related to: insecticide resistance to DDT and alternatives; new alternative products, covering the work of the Persistent Organic Pollutants (POPs) Review Committee; the transition from DDT in disease vector control; and a decision support tool for vector control.

7. The DDT Expert Group recognized a continued need for DDT in specific settings for disease vector control where effective or safer alternatives are lacking. The Group recommended that DDT in Indoor Residual Spray should be limited only to the most appropriate situations based on operational feasibility, epidemiological impact of disease transmission, entomological data and insecticide resistance management. It also recommended that countries undertake further research and implementation of non-chemical methods and strategies for disease vector control to supplement reduced reliance on DDT.

8. At its seventh meeting, POPRC established an ad hoc working group to assess the chemical alternatives recommended by the World Health Organization for disease vector control.

Annex 6 The Alternatives Subject to Assessment

No.	Insecticide	Group	Endosulfan alternative	DDT alternative
Alternatives to Endosulfan (Category 2 substances) and DDT				
1	Alpha-Cypermethrin	Pyrethroid	x	x
2	Cypermethrin	Pyrethroid	x	
3	Bendiocarb	Carbamate		x
4	Bifenthrin	Pyrethroid	x	x
5	Chlorpyriphos	Organophosphate	x	
6	Cyfluthrin	Pyrethroid	x	x
7	Cyhalothrin	Pyrethroid	x	
8	Gamma-Cyhalothrin	Pyrethroid	x	
9	Lambda-cyhalothrin	Pyrethroid	x	x
10	Deltamethrin	Pyrethroid	x	x
11	Dicofol	Organochlorine	x	
12	Esfenvalerate	Pyrethroid	x	
13	Etofenprox	Pyrethroid	x	x
14	Fenitrothion	Organophosphate	x	x
15	Fenvalerate	Pyrethroid	x	
16	Flucythrinate	Pyrethroid	x	
17	Flufenoxuron	Benzoylurea	x	
18	Hexaflumuron	Benzoylurea	x	
19	Malathion	Organophosphate	x	x
20	Novaluron	Benzoylurea	x	
21	Primiphos-methyl	Organophosphate	x	x

No.	Insecticide	Group	Endosulfan alternative	DDT alternative
22	Propargite	Sulfite ester	x	
23	Propoxur	Carbamate		x
24	Tralomethrin	Pyrethroid	x	
Alternatives to Endosulfan (Category 1)				
25	Lufenuron	Benzoylurea	x	
26	Pyridalyl	Unclassified	x	
Alternatives to Endosulfan (Category 3)				
27	Beta-cypermethrin	Pyrethroid	x	
28	Chlorfluazuron,	Benzoylurea	x	
29	Prothiofos	Organophosphate	x	
30	Pyridaben	Pyridazinone	x	
31	Spinetoram	Unclassified	x	
32	Tolfenpyrad	Pyrazole	x	

Data availability and uncertainties

9. The task provided to the working group by POPRC decision 7/4 and 7/8 was to carry out an assessment of the POP characteristics of the alternatives identified. For endosulfan 110 alternatives were identified and for DDT 11. Such numbers oblige a stepwise approach due to limitations of time and information. Therefore, no comprehensive assessment, such as applied in risk profiles, could be carried out here and most attention was paid to the substances which seemed to be most relevant based on the available data.

Assessment of alternatives to DDT

10. Conference of the Parties to the Stockholm Convention on Persistent Organic Pollutants requested the Committee, beginning at its eighth meeting, to assess alternatives to DDT in accordance with the general guidance on considerations related to alternatives and substitutes

for listed persistent organic pollutants and candidate chemicals[2] on the basis of factual information provided by parties and observers.

Summary report on the assessment of chemical alternatives to DDT

11. The substances recommended by the World Health Organization for disease vector control in indoor residual spraying as alternatives to DDT were assessed for persistent organic pollutant characteristics. To facilitate the work of the DDT Expert Group without duplicating it, the Committee focused on the scientific and technical work relating to persistent organic pollutant characteristics of the alternatives assessed. The Committee did not evaluate economic information on alternatives to DDT, including information on the availability and accessibility of alternatives to DDT relating to the evaluation by the Conference of the Parties of the continued need for DDT for disease vector control.

12. A full report on the assessment can be found in document UNEP/POPS/POPRC.8/INF/30. In addition, fact sheets that include information relating to 11 chemical alternatives to DDT are set out in document UNEP/POPS/POPRC.8/INF/31.

Assessment of chemical alternatives to DDT

A total of 11 chemical alternatives to DDT were assessed for persistent organic pollutant properties. The outcome of the assessment of the alternatives to DDT is presented in annex IV to the full report. In summarhe alternatives were classified as follows

Class 1: substances that the committee considered met all Annex D criteria None
Class 2: substances that the committee considered might meet all Annex D criteria but remained undetermined due to equivocal or insufficient data Bifenthrin
Class 3. substances that the committee considered not likely to fulfil the criteria in Annex D Alpha-cypermethrin, bendiocarb, cyfluthrin, lambda-cyhalothrin, deltamethrin, etofenprox, fenitrothion, malathion, pirimiphos-methyl and propoxur
Class 1: substances that the committee considered met all Annex D criteria **None**
Class 2: substances that the committee considered might meet all Annex D criteria but remained undetermined due to equivocal or insufficient data **Bifenthrin**
Class 3. substances that the committee considered not likely to fulfil the criteria in Annex D **Alpha-cypermethrin, bendiocarb, cyfluthrin, lambda-cyhalothrin, deltamethrin, etofenprox, fenitrothion, malathion, pirimiphos-methyl and propoxur**
Class 1: substances that the committee considered met all Annex D criteria None
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4. It is important to note that the assessment of the persistent organic pollutant characteristics of the alternatives should not be seen as a comprehensive and detailed assessment of all available information, because only a limited number of databases have been consulted.

15. The fact sheets on which the assessment is based provide an analysis on a screening level as to whether a substance meets the numerical thresholds in Annex D to the Stockholm

Convention, but contain no analysis of monitoring data or other evidence as provided for in Annex D.

16. Therefore, failure to meet the thresholds should not be taken as evidence that the substance is not a persistent organic pollutant. In addition, substances that according to this report are not likely to fulfil the criteria in Annex D may still exhibit hazardous characteristics that should be assessed by parties and observers before considering such substances to be suitable alternatives to DDT.

Kenyan Situation on DDT Use

Banned in 1986 for agriculture use but remains restricted only for public health use.

Annex 7: Pesticide POPs Alternatives

Plant-based pesticides available in Kenya

Trade names of products	Active substances of products	Target pest/disease	Agent / distributor
Achook 0.15 EC	Azadirachtin (0.15%)	Insect pests in horticultural crops and flowers; leafminers on coffee	Organix Ltd
Flower DS EC	Pyrthrins (4%)	Aphids and whiteflies on vegetables	KAPI Ltd
Flower Killer Sticks	Pyrthrins (0.5%)	Mosquitoes in domestic dwellings	KAPI Ltd
GC-3EC	Cotton seed oil (31%) + garlic extract (23%)	Powdery mildew on roses	Juanco SPS Ltd
GC-Mite EC	Cotton seed oil (40%) + olive oil (20%) + garlic extract (10%)	Red spider mites on flowers (roses)	Juanco SPS Ltd
Neemark EC	Azadirachtin (0.03%)	Aphids, thrips and root-knot nematodes in French beans	Osho Chemical Industries Ltd
Neemraj Super 3000	Azadirachtin (0.03%)	Aphids, thrips, whiteflies, diamondback moth, bollworms in vegetables and roses	Amiran (K) Ltd
Neemroc 0.03 EC	Azadirachtin (0.03%)	Diamondback moth in brassicas and thrips	SaroneemBiopesticides
Nimbecidine EC	Azadirachtin (0.03%)	Aphids, thrips, whiteflies, leafminers, cucmber beetles, spider mites in vegetables	Osho Chemical Industries Ltd
Pydust	Pyrthrins (1.0%)	Grain storage pests (rice and maize weevils)	Pyrethrum Board of Kenya
Pyegar	Pyrethrin + garlic extract	Red spider mites on flowers (roses)	Juanco SPS Ltd
Pyerin EC	Pyrethrin (75g/l)	Aphids and whiteflies on flowers and vegetables	Juanco SPS Ltd
Pylarvex 0.5 E	Pyrthrins (0.5%)	Mosquito larvae in public health	Pyrethrum Board of Kenya
Pymos 0.6 EC	Pyrthrins (0.6%)	Mosquitoes in public health	Pyrethrum Board of Kenya
Pynet 5 EC	Pyrthrins (0.5%)	Impregnation of bed nets against mosquitoes	Pyrethrum Board of Kenya
Pytix 4EC	Pyrthrins (40g/l)	Ticks on cattle in areas defined by the Director of	Pyrethrum Board of Kenya

		Veterinary Services	
Trilogy 70 EC	Clarified hydrobic extract of neem oil (70%)	Powdery mildew, downy mildew and botrytis in roses; anthracnose, angular leaf spot and rust in French beans	Farmchem (K) ltd

Biopesticides (biocontrol agents) available in Kenya

Trade names of products	**Active substances of products**	**Target pest/disease**	**Agent / distributor**
Amblytech	*Amblyseius californicus* (predatory mite)	Red spider mites (*Tetranchus urticae*) on vegetables	Dudutech (K) Ltd
Amblytech C	*Amblyseius cucumeris* (predatory mite)	Thrips and spider mites on flowers in greenhouses	Dudutech (K) Ltd
Aphitech	*Aphididius transcapicus* (parasitic wasp)	Aphids (*Aphis spp*. and *Acrosiphum spp*. on vegetables	Dudutech (K) Ltd
Bacticide WP	*Bacillus thuringiensis var. israelensis*	Mosquito larvae in breeding sites	Insect (K) Ltd
BioDewcon 2 WP	*Ampelomyces quisqualis* (fungus)	Powdery and downy mildew on courgettes and snowpeas	Osho Chemical Industries Ltd
BioCatch 1.15 WP	*Verticillium lecanii* (fungus)	Aphids and whiteflies on French beans and tomatoes	Osho Chemical Industries Ltd
Biolep WP	*Bacillus thuringiensis var. kurstaki*(bacterium)	African bollworms on French beans	Insect (K) Ltd
Bio-Nematon 1.15 WP	*Paecilomyces lilacinus* (fungus)	Root-knot nematodes in French beans, roses and tomatoes	Osho Chemical Industries Ltd
Bio-Power 1.15 WP	*Beauveria bassiana Strain GNA*(fungus)	Aphids and diamondback moth on cabbages	Osho Chemical Industries Ltd
Botanigard ES	*Beauveria bassiana* Strain GNA (fungus)	Aphids, thrips and whiteflies on French beans and snowpeas	Amiran (K) Ltd
Delfin 6.4 WG	*Bacillus thuringiensis var. kurstaki*Strain SA-11 (bacterium)	Diamondback moth on brassicas and giant looper on coffee	Farmchem (K) Ltd
Diglytech	*Diglyphus isaea* (parasitic wasp)	Leafminers (*Liriomyza spp*.) on flowers and vegetables	Dudutech (K) Ltd
Dipel 2X	*Bacillus thuringiensis var. kurstaki*Strain ABTS-351 (bacterium)	Lepidopteran larvae (caterpillars) in coffee and horticultural crops	Safina (EA). Ltd

Dipel DF	*Bacillus thuringiensis var. kurstaki*Strain ABTS-351 (bacterium)	Lepidopteran larvae (caterpillars) (*Helicoverpa armigera; Spodoptera exigua*) plus leaf-rollers on carnation and roses	Safina (EA). Ltd
Ditera DC	*Myrothecium verrucaria* (fungus)	Nematodes in ornamentals	Safina (EA). Ltd
Eco-T WP	*Trichoderma harzianum* Strain k.d. (fungus)	Soil-borne diseases (*Fusarium, Pythium and Rhizoctonia*)	Lachlan (K) Ltd
Encartech	*Encarsia formosa* (parasitic wasp)	Whiteflies (*Trialeurodes vaporariorum and Bemisia tabaci*) in greenhouses	Koppert Biological Systems (K) Ltd
Ercal	*Eretmocerus eremicus* (parasitic wasp)	Whiteflies (*Trialeurodes vaporariorum and Bemisia tabaci*) in greenhouses	Koppert Biological Systems (K) Ltd
Florbac 70 DG	*Bacillus thuringiensis var. aizawai*(bacterium)	Giant looper in coffee	Safina (EA) Ltd
Halt 50 WP	*Bacillus thuringiensis var. kurstaki*(bacterium)	Diamondback moth in brassicas and caterpillars on roses	Osho Chemical Industries Ltd
Nematech	*Steinernema feltiae* (nematode)	Thrips, leafminers, cutworms and sciarid flies on carnations	Dudutech (K) Ltd
Phytoseiulus System	*Phytoseiulus persimilis* (predatory mite)	Red spider mites on roses and French beans	Hygrotech (K) Ltd
Phytotech	*Phytoseiulus persimilis* (predatory mite)	Spider mites (*Tetranychus urticae*) in vegetables	Dudutech (K) Ltd
PL-Plus	*Paecilomyces lilacinus* (fungus)	Nematodes in roses	Juanco SPS Ltd
Planopar	*Coccidoxenoida perminutus* (parasitic wasp)	Mealbugs on roses	Koppert Biological Systems (K) Ltd
Real Phytoseiulus	*Phytoseiulus persimilis* (predatory mite)	Red spider mites on roses and French beans	Real IPM Company (K) Ltd
Rootgard	Trichoderma harzianum Strain 21 (fungus)	Soil-borne diseases (Fusarium spp.) in flowers (carnation)	Juanco SPS Ltd
Spical	*Amblyseius (Neaseilus) californicus*(predatory mite)	Spider mites on roses	Koppert Biological Systems (K) Ltd
Spidex	*Phytoseiulus persimilis* (predatory mite)	Spider mites on roses	Koppert Biological Systems (K) Ltd
Swirski-Mite	*Amblyseius*	Whiteflies on roses	Koppert Biological

	swirskii (predatory mite)		Systems (K) Ltd
Thripex	*Amblyseius cucumeris* (predatory mite)	Flower thrips and spider mites on carnation grown in greenhouses	Koppert Biological Systems (K) Ltd
Thuricide HP	*Bacillus thuringiensis var. kurstaki*(bacterium)	Lepidopteran larvae (caterpillars) on vegetables and giant looper on coffee	Farmchem (K) Ltd
Trianum-P 11.5 WP	*Trichoderma harzianum* Rifai Strain KRL-AG2 (T22) (fungus)	Soil-borne fungal diseases caused by Pythium, Rhizoctonia and Fusarium spp. in French beans	Koppert Biological Systems (K) Ltd
Trichotech	*Trichoderma asperullum* (fungus)	Soil-borne fungal diseases caused by *Pythium, Rhizoctonia and Fusarium spp*. in French beans	Dudutech (K) Ltd
Xentari WDG	*Bacillus thuringiensis var. aizawai*(bacterium)	Giant looper on coffee	Safina (EA) Ltd

Annex 8 TOR

Tasks under their consultancy

i. Review of the Kenya NIP 2007 and its annexes with regard to pesticides
ii. Address new obligations under the Convention focusing on relevant changes that may have occurred since the previous assessment,
iii. Assessment of the implementation of action plans (e.g. changes regarding the production, import, and export of POPs pesticides, related changes in the legal framework and institutional infrastructure),
iv. Need for action plans to address the changed status and new obligations with specil consideration to DDT and its alternatives
v. A review for Kenya of non chemical alternatives to pesticides in general and emphasizing on DDT
vi. Assess how the Stockholm Convention Region Centre for Africa can promote non chemical alternatives through technical assistance and capacity building programmes
vii. Indicate how Kenya will address Article 15 of the Convention which requires each Party to report to the COP on the measures it has taken to implement the provisions of the Convention and on the effectiveness of such measures in meeting the objectives of the Convention

Outputs and outcome

The outputs expected are report and annexes

i. Historical and current production, import, export, use, stockpiles and waste disposal for POP pesticides.
ii. A report on DDT use/stocks science and facts regarding introduction of alternatives
iii. Proposals for exemption if any
iv. The potential for non chemical alternatives and the role of the Africa Region Centres
v. A detailed account of the legal, institutional, regulatory and enforcement systems for POPs pesticides.
vi. A detail account of the data gaps and deficiencies in the knowledge on POPs pesticides.
vii. Present elements to develop an action plan to address pesticides in the context of the NIP.
viii. Detailed action plans to address the changed status and new obligations
ix. Indicate how Kenya will address Article 15 of the Convention which requires each Party to report to the COP on the measures it has taken to implement the provisions of the Convention and on the effectiveness of such measures in meeting the objectives of the Convention

Annex 9 Team Members

Pesticide POPs

Dr Laetitia Kanja	Consultant (UoN)
Dr W. Lwande	ICIPE/ Africa Stockholm Region Centre
Carol Wamai	Government Chemist
L. Kalawa	PCPB
P. Opiyo	PCPB
P. Wanjohi	MoH

Annex 10 Detailed Reports of the Visited Areas

REPORT OF POPS INVENTORY AND FIELD WORK

1. ATHI RIVER MAVOKO TOWNSHIP.

Visited Portland Cement Company located Athi River/Naivasha Road.

- Management is not aware about the Stockholm Convention requirements,
- Not aware of BAT/BEP guidelines

People met:

- Peter Kamwere head of Inspection and training
- GG wachira(0724099888
- Ruhiu- Head of deaprtment

Visited Portland Cement Company located Athi River/Naivasha Road.

Persons met

Patience: Head of Health Environment and safety

Issues that arose

- Using coal extensively
- Not aware of the Stockholm Convention
- No Policy
- Not aware of BAT/BEP guidelines
- Not currently burning hazardous waste but considering to do so using rice husks is on trial. The factory will also try rice and coffee husks, harvesting of thinnngs in the city.
- Are concenned by the high fuel costs.
- Have a dedicated Environment and Health Officer with about 4 interns.
- Discussec technologies, air pollution control

Bamburi Portland Cement

People met

Miriam Ngolo Group Manager for Larfarge tel 374119/3745861, 0733718/0722242243

Located on Namanga/Athi River road.

- Receiving charcoal from Sultan Hamud.
- Process involves high temperatures – 1200^{o}C.
- Currently using coal extensively, contemplating using waste for heating and have a license to burn waste.

Currently producing

People met:

Way forward

- Share BAT/BEP
- Discuss the burning of waste
- Consider additional assistance

Chloride Exide

Date visited:

Category covered- Incineration

Issues discussed

- Receiving care batteries from all over Kenya
- Puts aside the plastic casing
- Casing delivered to NAS Plastic where it is pelletised.
- Pellets sold to another processor to make various products
- Not monitored for dioxins and fuels.
- Not aware about the Stockholm Convention
- Not aware of BAT/BEP guidelines

People met:

Visited Portland Cement Company located Athi River/Naivasha Road.

Persons met

Issues that arose

- Using coal extensively
- Not aware of the Stockholm Convention
- No Policy
- Not aware of BAT/BEP guidelines
- Not currently burning hazardous waste but considering to do so using rice husks.
- Concerned by the high fuel costs.
- Have a dedicated Environment and Health Officer with about 4 interns.

Bamburi Portland Cement

Located on Namanga/Athi River road.

- Receiving charcoal from Sultan Hamud.
- Process involves high temperatures – $1200^{o}C$.
- Currently using coal extensively, contemplating using waste for heating and have a license to burn waste.

Currently producing

People met:

Way forward

- Share BAT/BEP
- Discuss the burning of waste
- Consider additional assistance

Chloride Exide

Date visited:

Category covered- Incineration

Issues discussed

- Currently doing 1000tons per month on a 24hour shift
- Generating approximately 300tons of plastic waste
- Plastic is sent to NAS enterprise for regrinding and resale to make basins and other containers
- Temperature ranges between 600-800deg centigrade
- Receiving care batteries from all over Kenya
- Puts aside the plastic casing
- Casing delivered to NAS Plastic where it is pelletised.
- Pellets sold to another processor to make various products
- Not monitored for dioxins and fuels.
- Not aware about the Stockholm Convention
- Not aware of BAT/BEP guidelines

People met:

NAIROBI.

FIELD VISIT TO DANDORA DUMPSITE - 17/11/2013

OBJECTIVE

To have a rapid view of current status of dumpsite and familiarize with activities there in.

Stakeholders

- **Petter kebew recycler**
- **John ndicu recycler**

- 3 members of Dandora Action group

Findings

- Dump site still in operation
- Wastes dumped include; papers, cartons, metal, plastics, glass, plastic and polythene
- There are attempts to sought waste to sell to recyclers
- Polythene papers rarely sought due to lack of buyers for recycling
- Waste is burned with thick smoke emanating from dump site
- Smoke could be smelt 2 km from dump site
- Polythene papers were scattered adjacent to dump site and indications of road side dumping evident
- No waste volume reduction is done on dump site prior to selling waste to recyclers
- Only registered and influential waste collectors are allowed by organized groups(Not city Council despite them being allowed) to dispose waste inside dump site
- CBOs not allowed to dump unless with prior arrangements by boys in dump site
- CBOs collecting domestic waste rarely sought their waste for recycling
- Financial constraints has hampered CBOs intending to establish recycling systems
- Some attempts had been done to organize CBOs into groups with a view to establish common recycling systems especially by Pamoja Trust but with no success due to unwilling of groups in different constituency to form one network that will establish a recycling system
- Suspicion has been major factor hindering various groups to join and cost cut in establishing a recycling system

Way Forward

CBOs members have resourceful information towards the project and will be consulted extensively.

2. LIMURU TOWNSHIP

Bata Shoe Company, Limuru

Category covered: leather Finishing with chloanil

Date Visited:2 nd Dec 2013

People Met:

- Penina Kariuki HR secretary to EHS Committee
- Benson Maede Chemist
- Peter Giathi- Chair to EHS Committee

Issues discussed.

i. Processing of shoes with PVC using PVC and DOP as the major raw materials
- Chemicals imported from India and Korea
- PVC pre-heated, DOP added, pelletized to make soles for cheap soles, Safari Boots.
- Extensive use of rubber to make slippers.
- Fugitive emissions identified.
- Solid waste generated is recycled. The rest is taken by a private contractor for disposal off premises

Tannery section:

- Processed leather imported from around the country in Kenya. Extensive trimmings and …
- Dried and dyed with various dyes and pigments. They were unidentifiable
- It was not possible to know whether the finishing is with chemicals listed under the convention.
- It was observed that the tannery section has poor housekeeping with chemical containers strewn all over. Labels were off; it was not possible to identify the chemicals used.
- Solid waste generated is collected by a contracted person and disposed elsewhere mostly in Dandora some 50 kilometers away. The site at Ngubi previously used by Bata Shoe is abandoned and can be considered as a contaminated site
- There is a waste water treatment plan conventional with casing, precipitation setting and oxidation. The effluent treatment plant is well operated. However chemicals of interest to the Stockholm Convention are not analyzed as that capacity does not exist.
- Sludge is collected by the solid waste vendor. Volumes and quantities are not known.

Issues raised;

- Company to fill in questionnaire provided
- Company to give details of fire extinguishing chemicals as some could be the enw POPs
- Analysis of waste water and the discharge point at Ithanji Dam in Limuru at Tigoni Dam.

3. NAIVASHA SUBCOUNTY

Public Health Offices

People met

- James Kinyua Public Health Officer Naivasha sub County Central Divisiosn9 central, Mai Mahiu, Oserian
- Caroline Vata –deputy Public Healtgh Officer(0722837471)
- Izekiael Bow
- Muigai Stephen @yahoo.com90722241559)
- 

Email carolinevata @yahoo.com

The Public Health Office is charged with responsibility over disease surveillance and compliance to public health.

The key issues discussed were Pesticides use, disposal of medical waste and research.

Issues Discussed:

i) Pesticides
- It was noted that DDT is not used though malaria is prevalent
- Most prevalent diseases are diahhrea and upper respitratory tract infections
- It was noted that there is need for health professional to have access to information on POPs
- Regulary IRS is carried out using ICON, a pyrethroid
- Aerial spraying where organophosphates are used is also prevalent with no complaints
- It was noted that the county buys its chemicals in bulk from KEMSA supply.
- The officers recalled that two (2) year ago there was extensive fish deaths in Lake Naivasha. Chemicals were suspected. This was however not proved as samples were taken for analysis and the results retained by headquarters.
- The subcounty office has data for prevalent diseases (Malaria, URT, diarrhea, etc) but not diseases that can be associated with POPs.
- All flower farms claim compliance.

ii) Wastewater Disposal
- Waste water treatment is inadequate, the sewage treatment finally discharges into Lake Naivasha, so does all the flower farms.
- Typical analysis is biological oxygen demand, chemicals oxygen demand, suspended solids, PH.
- There is need to analyse POPs related parameters for the sewage, leachate fro the dumping ground, and for the flower farms.
- There is need for integrated town planning to better design solid and liquid waste treatm,ety

iii) Solid waste disposal
- Medical waste is not well organized. Two incinerators, one at Naivasha District Hospital and the other at Oserian Flower farm.
- There was no awareness of the need to treat medical waste in a specific way.
- There are challenges for disposal of health waste
- Usually in health centres a burning chamber is used. There is one such burner in one district
- It is proposed to have 2 per district
- The PHD staff have a high regard on the burner at Oserian . they are suspected to work at 900C.
- The so called BAT incinerator costed Ksh 320,000 in 2005
- It has served Oserian Flowers well taking into account that waste generation is not high

- Some health centres and dispensaries h  ave health boxex each bos weighs 50kg and it costs Ksh 75 to dispose.
- It was noted that the incinerator at the Naivasha General Hospital consumes a lot of diesel though it is working well.
- It was noted that health cntres are not bringing their waste to this facility for disposal.
- Many healtrh centres alsi bury their medical waste
- There is Bowen Incinerator at the Naivasha distric hospital. The team was not able to see it

<u>Issues raised for followup</u>

- NIP PMU to send the subcounty BAT/BEP guidelines for the incinerators and Waste Disposal guidelines.
- Medical waste to be taken to District Hospital for incineration
- Follow up on the uses of hospital data
- There is need to stock antidotes
-  It was noted that allergies are prevalent causing asthama.
- Spareeayers surfer from cases of dermatitis because of the personal protection equipment that they use. For this reason there is a new practice of

People seen:

4. OSERIAN FLOWERS FARM

People met

- Erastus owino-Nurse in charge
- Dr Khan in Charge 0722801787

Oserian Flowers is located 27 kms from Naivasha town. It has some 12,000 employees and is fully self contained.

It was noted that;

- Reported that it has a good chemicals policy
- Non of the POPs listed is used
- There is extensive promotion of non chemical alternatives to flower growing. Use of DUDU TECH is prevalent
- It has Best Environmental Practices in place, to avoid the use of pesticides.
- Has strong public private partnership with Olkalia geothermal plant to waste steam.
- Currently using soilless cultures extensively.
- It has a fully functional medical facility that includes a day care and outpatient.
- It has one of the more functional "incinerators" which seemed well utilized. However it is a burner not incinerator.
- Utilized exclusively by the Oserian medical facility only.
- Improvement suggestions were made.
  Follow up will include best practices in
  Soiless cultures
  Hydrophonic cultivation
  Use of coconut bed

5. NAKURU MUNICIPALITY:

People met

- Mr Osumo County Director of environment 0712371180
- Francis Irungu 0722673431

- Sara Ruo

a) Nakuru County Environment Office.

i. NEMA office in Nakuru though with limited staff is mandated to monitor a vast area comprising of Nakuru county and its environs. The office is currently is incapacitated bylack of transport to criss cross its designated area hence making monitoring and enforcement of EMCA regulations a daunting task bearing the fact of high number of business and settlement facilities.
ii. The county office has not prioritized
iii. NEMA has identified Gioto Dumpsite as prime source of POPs emission in the area and other periphery sources in Free Area, Suburb and Industrial area estates with prolific episodes of tyre burning by street boys and private entrepreneurs.
iv. The NEMA office currently lack regulations to adequately prosecute individuals burning POPs and eagerly anticipating the enactment of Air Quality Regulations that are yet to be adopted by parliament and gazetted. However, the office would greatly prefer a regulation that is specifically on POPs.
v. The NEMA office is currently appalled by the dumping of waste along the roads in Nakuru town and Kabarak road that provides access to Gioto dump site. The office is greatly dissatisfied by explanation of Municipal in regards to vandalism of dump site peripheral fence and uncomfortable with the slow pace in decommissioning of current Gioto dumpsite and establishing a modern landfill at Delamare farms.
vi. The NEMA office has licensed some plastic recycling companies including Clip Cut industries that recycle huge amounts of POPs, though most of them have to be pushed and threatened on consequential actions like closures and prosecution.
vii. The NEMA office recognizes separation and sorting of waste at source as singular intervention that can result to zero plastic dumping due to enhanced recovery of POPs for recycling.

The team paid a visit to a plastic recycling factory situated in Industrial area which on daily bases shred an approximate of 6000 kilograms of POPs collected by CBOs and street boys in Nakuru Town, Njoro, Elburgon and Nyahururu. The factory processes POPs up to granules stage, which are then sold to factories in Nairobi for further processing into plastic products. Most of this POPs would have ended into Gioto dump site or littered all over the estates. However, though the e factory has all the potential to expand its recycling capacity especially in inject blowing POPs to products its financially limited due to high interest rates on loans from financial institutions. The Kenya Industrial Estate does provide very low and favorable interest rates but on small amounts hence some lobbying need to be done for more financial support from government.

The county Government ought to be lobbied to develop policies, laws, regulations and economic incentives that promote environment conservation. The NEMA official gave a highlight on immense role there officers are playing to ensure the Nakuru Municipal and waste collectors adhere to NEMA legislations. Some of hot spots that generate POPs in Nakuru identified by NEMA are Gioto dump site and isolated burning of worn out tyres in Surbub Estate and Industrial area. The NEMA office is mandated to cover a vast area upto Njoro and it has made remarkable achievements in enforcing Waste Management Regulations of 2006.Though the office is experiencing several challenges in deterring open burning of plastic due to lack of specific laws and regulations on POPs.

Conclusion and Recommendations

i. There is urgent need for NEMA to increase its enforcement mechanisms by increasing workforce and mobility of staff and decentralize its operations to smaller units
ii. The government and municipal councils ought to initiate the development of specific regulations on POPs that enhance collection and promote recovery of POPss in Kenya.
iii. The municipality should be facilitated to quicken the decommissioning of Gioto Dump site and establishment of a modern land fill.
iv. More awareness need to be raised on regulations in Environment Management and Coordination Act and stakeholders facilitated to comply with various regulations in waste management including international conventions in hazardous chemicals and waste; Basel, Rottendam and Stockholm Convention Secretariat..
v. There is urgent need for public to be encouraged and facilitated to separate waste at its generation point.

5. Nakuru Provincial Hospital.

Nakuru is and Naivasha are some of of few major towns in Kenya with an inherent reputation as a clean town use of pesticides and home to some of Kenya's important Ramsar Sites namely lake Naivasha and Lake Nakuru. Nqivasha is also renown for hosting the largest number of flower farms producing world class flowers for international markets The familiarization field visit was aimed at making a rapid assessment on use of pesticides and chemicals under international control and some of the best environmental practices using non chemical alternatives, emission of POPs from POPs and hold consultations with various stakeholders in POPs waste management in a view to have a situation analysis on current environmental management systems. The fundamental objectives of visit were geared towards raising awareness on POPs to stakeholders, evaluate POPs management systems from cradle to grave and identify options to initiate and scale up interventions that reduce generation and eventual disposal of POPs into our waste streams. The visit also went a long way in reinforcing The oproject management units environment awareness and advocacy on reduce, reuse and recycle as well as *monttaini* spirit of showing gratitude and gratefulness on resources.

The field visit was conducted from 2nd to 3th December 2010 by Newon Maina and Michael Mutua. Fruitful consultations were made with Nakuru Environment Department officials including the Cleansing Superintendent, James Kamau who gave an elaborate insight on role of municipal in waste management. Nakuru municipal has a systematic partnership with CBOs who are mandated to collect waste from zoned sections of Nakuru in addition to collect waste levies from residents on behalf of municipal. The only dump site is situated at Gioto, which is currently in deplorable state due to absolute negligence and POPs emission was evident from open burning of POPs. The municipal should be advocated to initiate environmentally sound damping to mitigate on foul smell and potential health hazards as well as enforce laws that deter littering of POPs. However, participation of public in supporting waste management initiatives is generally low and much sensitization on 3Rs need to be undertaken.



6. Kenya Farmers Association

Held discussions with the manager - None of the POPs is in the stores.

7. Gioto Solid waste Dumping

Observations

i. There is evident of open burning of waste in the dump site and consequent emission of POPs.
ii. Huge chunks of waste were dumped along the roads leading to the dumpsite.
iii. Some scavengers undertake minimum collection of recyclables like POPs, metals, glass and papers

iv. POPs was the most conspicuous in the dump site and it was evident that due to its non biodegradable characteristic, most of organic matter that would have easily degraded into soil was held up in the plastic papers.
v. According to Dump site official, if a zero POPs regulation would be imposed and enforced, the dump site would not be in its deplorable state.
vi. No systematic sorting of waste is being conducted in the open dump site apart from the scavengers the percentage of POPs collected is very negligible due to hardships in separating the dirty and foul smelling mixed wastes
vii. Most of scavengers were exposing themselves to health hazards since they didn't have any health protective gears like gloves, gumboots

Nakuru Gioto Dumpsite

- **Some of challenges identified by participants were;**

i. Unwilling of Nakuru residents to pay for waste collection fees that range between Kenya shillings 100 to 200 per client per month, public are ignorant and have negative attitudes to initiatives on waste management,
ii. low enforcement of municipal in ensuring public abide to anti littering by laws, CBOs have low finances to effectively collect and transport waste,
iii. CBOs view the charges by municipal as a bit high especially on remitting 10% of their gross income to municipal in addition to paying license and dumping fees,
iv. poor road roads that lead to the Gioto dumpsite,
v. uncertainty and suspicions in reference to decommissioning of Gioto dumpsites,
vi. poor financial management of CBOs,
vii. Most CBOs have limited means of generating income
viii. most groups lack capacity to understand and comply with NEMA regulations,
ix. Some women groups experience challenges in selling products from recycled POPs and papers like ornaments and baskets due to lack of market outlets and Kenyan market not interested in buying unique local products unlike in Western countries.

7. Kenya Seed Company

Held discussions with the Deputy manager

- Enquired whether any of the POPs is still in their stocks
- Aware of only Lindane which was recalled from all branches and stored in NAkuru branch.
- Currently 22 drums of 200 liters each stored in the facility and is used for seed dressing in wheat. The supplier, BUYER informed that was the last consignment and import of lindane.
- As for endosufan, she was not sure because of the trade name(to check with PCPB THE TRADE NAME)

REPORT OF THE POPS INVENTORY AND FIELD WORK IN COAST REGION

(From 13th- 16th January 2014)

PESTICIDES POPs

Objectives

Areas visited

Since it was not possible to visit all identified areas, the following areas were selected and visited:

NEMA County Office

NEMA County Director of Environment (Mr. Wachira Bore) briefed us on the NEMA activities in the cost region. They are not directly involved with POPs but are involved in reinforcing the regulations of solid waste. The challenges they have – no licensed dumpsite or landfill (environmental licenses and permits which includes EIA, effluent discharge, transporters, incinerators and recycles. Import/export for controlled substances etc.? to be clarified)

Kenya Ports Authority

(Contact person: Mr Francis Kombe)

Do not deal with POPs but Chemical handling and chemical safety.?

SGS Kenya Limited

(Contact personel: Augustine Owiti (Manager) and Walter Ogara (Multi Lab Manager)

Laboratory accredited. ISO. 2005. The lab has facilities and capacity to analyze most of the POPs. The laboratory is very well equipped with modern analtycal equipment, AAS, GC-MS LC Analysis of samples coordinated from the laboratory in Nairobi. Have analysed samples for Government institutions – NEMA PCPB, Kenya Bureau of Standards, other institutions, private and other ministries

The kind of samples include - waste water, chemicals, metals, pesticides including environmental samples – soil, water, air sampling emissions. Fish and fishery products, fresh cut flowers, formulations etc. and samples for export

The samples that cannot be handled in their Kenyan labs are sent to Belgian for analysis e.g. analysis for dioxins and furans. The lab is well organized; each section with specific function from the time the sample is received to its final result/report.

Were not aware of the POPs analysis in Kenya especially with regard to the Stockholm Convention but since they have the required capacity these can be handled with the proper arrangement.

KEMFRI

The contact person was not available the day we visited but we were to contact him later.

The institute deals with research in fisheries, aquaculture, ecology and environment, natural products, social-economics, information and data management.

Would have liked to know whether they were aware of the Stockholm Convention on POPs, their laboratory capacity to analyze for POPs and other related chemicals. POPs influence in aquatic ecosystem. The research activities that have been carried out and the levels of POPs present in aquatic ecosystem.

Kenya Revenue Authority

(Contact person: Tabitha Mwangi. Senior Assistant Commissioner –Customs Incharge)

Operates under the East African Community Customs Management Act, 2004 .

Our concern was on importation of POPs into the country with regard to the types of chemicals and quantities. All importers are required to fill a declaration form at the importation level as required by the act. The prohibited and restricted imports are generally checked at the entry point. The challenge they have occasionally is the identification of some chemicals especially with the use of trade and brand names instead of the chemical names. There is a lab at KRA but field officers do not have capacity identify some chemicals and therefore they need training especially for identification. Goods under seal are sent for analysis at KRA Lab in Nairobi (Kenya Times Towers). There is a conditional release of goods while waiting confirmation. Training required in identification, handling, includes counterfeit goods or items.

From the Act 2004 we noted the need to update the list of prohibited chemicals. The commissioner was not aware of the obligations of the Stockholm convention of which Kenya is Party to. Kenya Bureau of Standards use tariff number for each chemical.

Use of ICT for declaration

Prohibited and Restricted Imports

Hazardous wastes and their disposal as provided for under the base c(9)

(a) Agricultural Chemic

(i) 2.4 - T (ii) Aldrin(iii) Caplafol (iv) Chlordirneform l Chlorobenxilate l DDT (v) Dieldrin (vi) 1.2 - Dibroacethanel (EDB) (vii) Flouroacelamide (viii) HCH(ix) Hiplanchlor (x)

Hoscachlorobenzene (xi) Lindone (xii) Mercury com (xiii) Monocrolophs (certain ormulations)

(xiv) Methamidophos

(xv) Phospharrmion

(xvi) Methyl - parathion (xvii) Parathion

(b) Industrial Chemicals

(i) Crocidolite

(ii) Polychlorominatel biphenyls (PBB)

(iii) Polyuchorinted Biphenyls (PCB)

(iv) Polychlororinated Terphyenyls (PCT)

(v) Tris (2.3 dibromopropyl) phosphate (vi) Methylbromide (to be phased out in accordance with the MontrealProtocol by 2002

Others

Counterfeit goods of all kinds.

Plastic articles of less than 30 microns for the conveyance or packing of goods

Noted the following

Need for training, lab and field personel

capacity building

updating of prohibition Acts wih regard to chemicals and Kenyan policy

Awareness of the Stockholm Convention and other relevant internatonal treaties

KARI IN MTWAPA

Contact : Francis M. (Agric & industry)

William Munga (farm manager)

Activities: livestock, tree nursery, crop and commercial farming. Emphasis mainly on good agricultural

practice.

KARI – legal Office certified 2008

Observation: information dissemination lacking and lab capacity lacking. No analysis done.

No information available with regard to pesticide POPs. Banned chemicals discussed- carbofuran- furadan

which took long to be removed from the market

Disposal of waste: burying or burning. Audited externally/internally. No disposal mechanism

No POPs stockpiles or waste in the store.

KEMRI

(Contact person; Dr Mbogo)

Main research on alternatives to DDT in vector control/ malaria control DDT restricted for Use in Public Health. Other neighbouring countries quoted to have stopped use of DDT in vector control includes Ethiopia

A long discussion ensued with regard the alternatives to DDT which is expected to be phased Out. The other concern is the impact other chemicals would on the environment, soil and insect resistant. Insect resistant is high in Western Kenya. Pyrethroid insecticides have been the chemical of choice since the initiation in 2005. The large scale use in agriculture and livestock sectors may have contributed to the resistance among local mosquito populations. The Kenya Medical Research Institute has been monitoring the resistance of major malaria vectors to the insecticides used for indoor residual spraying and in bed nets. High levels of resistance to pyrethroids, the only insecticide class currently used for malaria control in Kenya, have been reported in many locations in high Malaria burden areas in the country. The question : Do we have alternatives in Kenya? The answer is that they are many but not enough research has been carried out due to lack of enough funds.
Environmental management – no chemicals required
Not working as as team- no national consultation e.g. ministries- MOA, MOH&S, MOEW&NR etc
Examples : fish production in Kilifi which was abandoned has become a breeding points/sites for mosquitoes – malaria parasite, malaria control requires Integrated Vector Management (IVM) which brings everybody on board and consultation. The importance of community involvement- management of water and
4) use of non chemical approach e.g. plant botanicals- insecticidal effects
Other use of insecticidal plants – Neem oil, use of coffee
For the last four years building capacity for POPs use and alternatives to DDT at ICIPE funded by Stockholm Convention which included:

- Training on pest management
- Managing resistance

Transition of research findings to policy required .Due to vector resistant to pyrethroids there is need to change the insecticide used for IRS to another class of insecticide with a different mode of action. Based on the outcome of recent studies in western Kenya investigating the efficacy, durability and social acceptability of non-pyrethroid insecticides,it is strongly recommended that Bendiocarb which belongs to the carbamate class of insecticides be used for IRS in place of the currently used pyrethroids. This should be alternated with other researched insecticides e.g. changed after 2 years in use part of resistance management

Recommendation
A monitoring plan for vector resistance especially in areas with a high level of agricultural pesticide use

Increased number of non-pyrethroids insecticides is necessary for future selection and application for IRS in the country.

Implementation for use of IVM policy

RIFT VALLEY, NYANZA AND WESTERN REGION REPORT

Pesticide POPs Inventory: Rift Valley, Nyanza and Western Region

RIFT VALLEY

- NEMA-Eldoret, KARI-Kitale, Kenya Seed- Kitale

WESTERN/NYANZA

NEMA- Kisumu, Maseno University

Kemri

COMMENTS

Kenya Seed- Kitale

- Lindane no longer used for seed dressing
- Alternatives already registered – imidacloprid,
- Few expired stocks in store requiring disposal

KARI – Kitale

- No use of pesticide POPs including lindane or endorsulfan- alternatives e.g. carbosulfanand others

Thiram was used for some time but no longer available

Have stocks of obsolute chemicals requiring disposal

NEMA – Kisumu

Municipal waste – a health hazard

- Illegal trade, influx of chemicals across the border
- Environmental monitoring research required

Maseno University

Collaboration of research activities highlited and discussed

Challenges: POPs residues still in our environment

Some of the observations noted:

- No stockpiles or obsolete pesticide P0Ps reported in all the areas visited except for a few expired chemicals not necessarily POPs that were reported in two sites.
- Some chemical stores require better organization
- No registers kept for expired chemicals and some had no labels
- Some workers reported getting sick after spraying

certain chemicals

- There was concern that there is a possibility of some banned chemicals entering the country from the neighbouring countries and repackaged
- Some of the banned pesticides formulated with others(not POPs) have been in use for some time but no longer available
- The cost of the alternatives e.g. Bendiocarb compared with pyrethroids suitable alternative for mosquito vectors which are resistant to pyrethroids.
- Community acceptability was high at 95% as evidenced in the study conducted in western Kenya in 2011
- Vector resistance
- Basically no single solution approach to malaria control
- Research for other pestcide POPs alternatives continues

Some of the challenges encountered during inventories

- In some areas authority /clearance to collect samples at the site/store was required
- Entry to some areas also required clearance
- Lack of adequate facilities for proper identification of POPs
- Labs not properly equipped and capacity to do some analysis lacking
- Time and resources not enough for a comprehensive inventory
- Lack of understanding of some stakeholders e.g. those holding obsolete POPs – detailed required information not given.

Report submitted by: 1. Kalawa L. Iki and Peter Opiyo

1. Alpha hexachlorocyclohexane and

2. Beta hexachlorocyclohexane

The two POPs are part of the pesticides POPs being updated in the new NIP. Report on the two pesticides is as detailed below:

Literature review

Relevant materials were studied to establish the production, importation, use and alternatives to the two pesticides POPs. Institutions dealing in pesticides provided the relevant reference materials. Upon investigation through literature review it was established that the two pesticides POPs have since been withdrawn from Kenya market.

Contaminated

The contaminated sites in Kenya include Kitengela, Menengai, Wajir and Madera. The sites were contaminated through burial of pesticides. During the time of deposition of the obsolete pesticides there was no human or animal habitation in those areas. However, currently human beings and animal habitation has spread in these areas. There is potential risk to both flora and fauna in these areas and their neighborhood. Mitigation is by excavation and safe disposal of the contaminated soils in these areas.

Manufacturers and distributors

There are several companies in Kenya that manufacture pesticides and others distribute pesticides within and without Kenya borders. All the factories inspected did not manufacture neither distribute any of the referred pesticides POPs.

Large pesticides users

These are mainly cereals and horticultural farms. All large users visited and inspected by PCPB inspectors indicated that the pesticides POPs are not in use and that there no stocks. According to their records the said pesticides POPs went out of market about ten years ago.

Interviews to stakeholders

Various stakeholders in the pesticides industry were interviewed. They comprised, stockists, distributors, large farms users. Seed breeders, among others. Results from the interviews indicated that they are not in circulation in the Kenya.

Regulation

Pesticides regulation is provided in Cap 346, Laws of Kenya. Cap 346 Laws of Kenya established Pest Control Products Board (PCPB) and PCPB designated as the National Authority on pesticides. The original Act has been reviewed through legal notices to address the emerging issues.

Production and Importation

The products were banned in Kenya in 1986. In consequence, therefore, there is no importation production or use of the products in Kenya. There are also no stockpiles of the products in Kenya.

Uses
The two products were used in seed treatment control soil borne pests. The products were therefore used by seed dressing companies.
Following the withdrawal of the two products alternatives have been developed.

Stockpiles
After thorough survey and inspection in all possible stores of the pesticides POPs, it was established that there are no stockpiles of both alpha hexachlorocyclohexane and beta hexachlorocychlohexane in the country.

Alternatives

Following the ban of the two products alternatives have since been developed. The alternatives are formulations of imidachloprid and chloropyrifos.
Several companies are importing and distributing the alternatives and that the alternatives have been accepted in the market
Disposal
During our survey in the Kenyan market there is no distribution of both products in the country. There are no stockpiles of the said product. Therefore there is no issue of their disposal.

Pesticides Stockpiles In Kenya

Pest Control Products (pesticides) are registered and regulated by Pest Control Products Board (PCPB). During surveillance by PCPB compliance inspectors illegal pesticides are encountered in the market. Illegal pesticides are in the categories of: expired, unregistered, smuggled, counterfeit and improperly labeled. All the illegal pesticides are impounded and collected by PCPB inspectors. As at December 2013, there was 200 tonnes of pesticides due for disposal. There is also a staggering 100 tonnes around the country in pilot collection centres.

Conclusion

The products were registered for use as seed dressing products for the control of soil borne pests. The products were banned in Kenya in 1986, therefore there is no importation or production of the two products. The alternatives have been developed and have been generally accepted. Disposal of the two products therefore is non issue in Kenya.