

MINISTRY OF ENVIRONMENT WATER AND NATURAL RESOURCES

**GEF WORLD BANK PROJECT ON UPDATING THE KENYA NATIONAL IMPLEMENTATION
PLAN FOR THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS.**

CONSULTANCY ON

**AN INVENTORY INDUSTRIAL POPS IN ELECTRICAL AND ELECTRONIC EQUIPMENT (EEE)
THAT BECOME ELECTRICAL AND ELECTRONIC WASTE AND RELATED WASTES
ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) IN KENYA**



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EXECUTIVE SUMMARY

Kenya is a party to the Stockholm Convention on persistent Pollutants (POPs) which ratified in September 2004, and developed its National Implementation Plan (NIP). In view of the amendments to the convention that added additional POPs, Kenya is required to review and update it in accordance with the provisions of article 7 of the Convention¹

The New POPs included industrial chemicals used in electrical and electronic equipment. The new POPs present in electrical and electronic equipment is polybrominated dibromo ethers (PBDES) in short. Their production and eventual disposal sometimes are a source of POPs. In Kenya there is no production of the new POPs.

The use of c-PentaBDE in printed circuit/wiring boards (PWBs) has been phased out. PWBs are a component of WEEE that ends up in certain developing countries, where the metals are recovered using primitive methods in the informal sector, or by simple smelters. This can be the source of certain levels of POP-PBDEs and PBDD/PBDF.

The main objective of the inventory is to assess the presence and current uses of POP-PBDEs within the country and to understand the likely quantities, health and safety management, and end-of-life treatment of POP-PBDE-containing materials. Then the National implementation plan will integrate the activities on POP-PBDE management in the overall management concept (re-use, recycling, and disposal) for material flows containing POP-PBDEs (e.g. electrical and electronic equipment/ waste electrical and electronic equipment (EEE/WEEE), and link these activities to the overall concept of sustainable production and consumption.

The inventory was carried through a desk study, field visits and use of the guidance given by the Convention Secretariat.

It was found that the electrical and electronic industry is the fastest growing sector in Kenya. Unfortunately most of these EEE are at the end of life. Some are used and if not good cannibalized, useful material reclaimed and deposited as garbage. This is the problem because most of it is burnt in the open contrary to the Stockholm Convention.

In 2009 Kenya generated an estimated 11,400 tonnes from refrigerators, 2,800 tonnes from TVs, 2,500 tonnes from personal computers, 500 tonnes from printers and 50 tonnes from mobile phones or a total of 18,000 tonnes of e-waste. However currently it must be approximately 25,000 tonnes.

It was noted that the data on entry of electrical and electronic equipment used or secondhand is not regulated, this calls for policies and guidelines to control the trade, and therefore the estimate for PBDE is grossly compromised. The report contains proposal for action at international, national, county and local level. It is recommended that a full-fledged project be formulated to carry out data for the key household, ICT and other equipment

¹http://www.pops.int/documents/convtext/convtext_en.pdf

Abbreviations/Acronyms

BAT	Best Available Technologies
BFRs	Brominated Flame Retardants
CCK	Communication Commission of Kenya
CCN	City Council of Nairobi
CFCs	Chlorofluorocarbons
CFSK	Computer for Schools Kenya
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CSR	Corporate Social Responsibility
EEE	Electrical and Electronic Equipment
EMCA	Environmental Management and Co-ordination Act
HBB	Hexabromobiphenyl
HCFCs	Hydrochlorofluorocarbons
ICT	Information and Communication Technologies
KEBS	Kenya Bureau of Standards
KRA	Kenya Revenue Authority
KTCIP	Kenya Transparency and Communication Infrastructure Project
LCD	Liquid Crystal Display
LCF	Licensed collection facility
MEA	Multilateral Environmental Agreements
MEMR	Ministry of Environment and Mineral Resources
MoIC	Ministry of Information and Communication
MoLG	Ministry of Local Government
MOU	Memorandum of Understanding
NEMA	National Environment Management Authority
NEAP	National Environment Action Plan
NGO	Non Governmental Organisation
NIPs	National Implementation Plans
PBDES	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated biphenyls
PC	Personal Computer
POPs	Persistent Organic pollutants
PVC	Polyvinyl chloride
PRO	Producer Responsibility Organisations
SAICM	Strategic Approach to International Chemicals Management
SC	Stockholm Convention
ULF	Unified Licensing Framework
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Programme
UPSs	Uninterrupted Powers Supplies
WEEE	Waste Electrical and Electronic Equipment

Table of Contents

EXECUTIVE SUMMARY	2
Abbreviations/Acronyms	3
List of figures.	5
List of Tables.....	6
Annexes	7
BACKGROUND	8
1.1 New POPs	8
1.2 New obligations under the Convention	9
1.3 Information on c-PentaBDE, c-OctaBDE and HBB.....	9
1.4 POP-PBDEs and HBB in the Convention	11
1.5 The 2007 NIP	12
1.6 Kenya Obligations under the Convention	12
2.0 OBJECTIVES AND METHODOLOGY OF INVENTORY	13
2.1 Objectives.....	13
2.2 The EEE/WEEE Inventory.....	13
2.3 Approach and Methodology	13
2.4 Planning the Inventory	15
2.5 Identification of Stakeholders.....	15
2.7 Desk Study	16
3.0 SITUATION ANALYSIS.....	17
3.1 Choosing Inventory Tiers.	17
3.2 Projections.....	17
3.3 The ICT Market in Kenya	18
3.4. Generation of Electrical and Electronic Waste in Kenya.....	19
3.5 Historical Generation Of Disposable WEEE.....	22
3.6 Sources of WEEE in Kenya	24
3.7 Case Study.....	25
3.2 Tier1: Inventory approach: Using CRT per capital data.....	32
4.0 THE LEGAL, INSTITUTIONAL, REGULATORY AND ENFORCEMENT SYSTEMS FOR PERSISTANT ORGANIC POLLUTANTS (PFOS, PFOSF AND PBDES).....	33
4.1 Guidance from the Convention	33
5.0 Action Plan.....	33
6.0 RECOMMENDATIONS.	36
REFERENCES.....	37
1.1Tasks under NIP consultancy	38
0.2 Outputs	38

List of figures.

Figure 1.3.1:	Routes of POP- PBDEs Contamination.....	8
Figure 1.4.1:	Structure of polybrominated diphenyl ethers (PBDEs)	9
Figure 1.3.1.1:	Schematic diagram of the life cycle of c-OctaPBDE and potential for emissions	11
Figure 2.3.1:	Overview of the national POP-PBDEs inventory development process.....	11
Figure 3.3.1.1:	Pre used computers at a retail shop in downtown Nairobi.....	15
Figure 3.3.1.2	an illustration of Laptops for schools. A government initiative.....	16
Figure 3.4.1:	housing of Computer casing at a dumpsite: Picture by Mark Karanja.....	16
Figure 3.4.2.1:	The ICT goods imports percentage of total goods imports in Kenya.....	17
Figure 3.4.2.2:	growth in trends in personal computers use in Kenya.....	18
Figure 3.4.2.3:	Population covered by mobile cellular network (%) in Kenya.....	18
Figure 3.5.2:	The Life Cycle of Electrical and Electronic Equipment.....	20
Figure 3.4.2.2	Growth in trends in the use of personal computers use in Kenya.....	21
Figure 3.4.2.3	Population covered by mobile cellular network (%) in Kenya.....	21
Figure 3.5.2	The Life Cycle of Electrical and Electronic Equipment	24

List of Tables.

Table 1.1.1	Former uses of c-OctaBDE in polymers/materials, the applications and products	6
Table 3.4.2.4:	Data Gaps in the number of EEE in Kenya.....	19
Table 3.5.1:	The life cycle of electrical and electronic equipment.....	20
Table 3.4.2.4:	Data containing the number of EEE in Kenya .Data is in quantities imported and the year...	22
Table 3.4.0.5	Average weight of EEE imported from 2005 - 2012.....	22
Table 3.5.1	The estimated weight and life cycle of electrical and electronic equipment.....	23

Annexes

Annex 2	Terms Of Reference.....	36
Annex 2.	List of E-waste inventories from developing countries.....	39
Annex 2:	Questionnaire to EEE importers	42
Annex 3.	Questionnaire for WEEE recyclers.....	43
Annex 4	Stakeholders meet	50

BACKGROUND

Kenya is a party to the Stockholm Convention on persistent Pollutants (POPs) which ratified in September 2004, and developed its National Implementation Plan (NIP). In view of the amendments to the convention that added additional POPs², Kenya is required to review and update it in accordance with the provisions of article 7 of the Convention³. The updated NIP should provide a framework for Kenya to develop and implement, in a systematic and participatory way, priority policy and regulatory convention obligations, capacity building and investment programs for the new POPs. The process of updating the NIPs will enable Kenya to establish inventories of products/articles containing new POPs, industrial processes using them and will also provide useful information on the concentrations levels and distribution of new POPs across Kenya.

The New POPs included industrial chemicals used in electrical and electronic equipment. Their production and eventual disposal sometimes are a source of POPs.

1.1 New POPs

The new POPs have impact to Kenya; this impact is being assessed prior to updating the NIP.

The updating of NIP will build upon the assessments developed and the current NIP, Policy and legal administrative measures taken during its implementation. It will take into account ongoing activities being undertaken under the chemicals and waste regime of Multilateral Environmental Agreements (MEAs) such as the Basel Convention on the Trans boundary movement of Hazardous Wastes and their Disposal, the Stockholm convention, Rotterdam Convention on the Prior Informed Consent Procedures for Hazardous and Toxic Pesticides and the Strategic Approach to International Chemicals Management (SAICM).

Table 1.1.1 Former uses of c-OctaBDE in polymers/materials, the applications and products (ESWI 2011)

Polymers/materials	Application	Articles
Acrylonitrile-Butadiene-Styrene (ABS)	Polymer casings/parts in electric and electronic appliances	Computer- and TV casings (CRTs); office equipment; (other electronic equipment)
High Impact Polystyrene (HIPS)	Polymer casings/parts in electric and electronic appliances	Computer- and TV casings (CRTs); office equipment
	Cold-resistant layer	Refrigerator
Polybutylen-Terephthalate (PBT)	Polymer casings	Electronic appliances
	Transport sector	Connectors in vehicles
	Household	Iron
Polyamide-Polymers	Textiles	Furniture
	Construction	Pipes and plastic foil

The use of c-PentaBDE in printed circuit/wiring boards (PWBs) has been phased out.⁴ PWBs are a component of WEEE that ends up in certain developing countries, where the metals are recovered using primitive methods in the informal sector, or by simple smelters. This can be the source of certain levels of POP-PBDEs and PBDD/PBDF (see e.g. Yu et al., 2008). The inventory of PWBs in Kenya needs to be carried out in relation to the POP-PBDEs inventory.

²At the 4th Meeting of the Conference of Parties in 2009 (COP 4)

³http://www.pops.int/documents/convtext/convtext_en.pdf

⁴The main flame retardant use in PWB is tetrabromobisphenol A and its derivatives.

1.2 New obligations under the Convention

In May 2009, the Conference of the Parties amended the Stockholm Convention to persistent organic pollutants (POPs) to add certain brominated flame retardants (BFRs) to Annex A. They include:

- Hexabromobiphenyl (HBB)⁵, and
- Two polybrominated diphenyl ethers (collectively referred to as POP-PBDEs in this document) specifically :
 - Hexabromodiphenylether and heptabromodiphenyl ether (HBDE) and
 - Tetrabromodiphenyl ether and pentabromodiphenyl ether (TBDPDE)

Like all POPs, these chemicals possess toxic properties, resist degradation, and bioaccumulate. They are transported through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems. Parties to the Convention, for which the amendments have entered into force, have to meet the obligations under the Convention leading to the elimination of the listed BFRs. Due to the complexity and magnitude of usage of the POP-PBDEs, eliminating them represents a challenge for many Parties. Kenya needs to inventory its possible production, import, export, use or trade.

These chemicals have been widely used in many industrial sectors for the manufacture of a variety of products and articles, including consumer articles. For example, POP-PBDEs have been used in the electronics industry for the manufacture of plastic casings for computer equipment and in the transport industry for the manufacture of foam cushioning in automobiles. This inventory therefore focuses on electronic waste arising from computer industry and the attendant generation of waste.

The newly listed industrial chemicals that are relevant to EEE and WEEE included Tetrabromodiphenyl ether, pentabromodiphenyl ether, hexabromodiphenyl ether and heptabromodiphenyl ether (POP-PBDEs) and HBB are listed under Annex A of the convention². Kenya must take measures to eliminate their production and use.

Article 3 of the Convention² sets out obligations relating to the recycling of POP-PBDEs, with specific details in Annex A, Part IV and V. According to these, a Party may allow recycling of articles that contain or may contain POP-PBDEs, and the use and final disposal of articles manufactured from recycled materials that contain or may contain POP-PBDEs. The condition of the exemption is that:

- i. The recycling and final disposal is carried out in an environmentally sound manner and does not lead to recovery of POP-PBDEs for the purpose of their reuse;
- ii. Kenya takes steps to prevent exports of such articles that contain levels/concentrations of POP-PBDEs exceeding those permitted for the sale, use, import or manufacture of those articles within the territory of the Party; and
- iii. Kenya notifies the convention Secretariat of its intention to make use of this exemption.

1.3 Information on c-PentaBDE, c-OctaBDE and HBB

Commercial PentaBDE (c-PentaBDE), the homologues “tetrabromodiphenyl ether and pentabromodiphenyl ether”⁶ as well as c-OctaBDE, “hexabromodiphenyl ether and heptabromodiphenyl ether”⁷ are listed under the SC.

TetraBDE, pentaBDE, hexaBDE and heptaBDE are listed in Annex A of the Convention, and their production and use have to be eliminated by Parties subject to the exemptions allowed by the Convention. These listed POPs are referred to in this document as POP-PBDEs.

⁵ Since known production of HBB stopped in 1970s, the majority of products and articles that contain HBB were disposed of decades ago. As a result, the scope of the HBB inventory in many countries may be limited.

⁶ With the main congeners 2,2',4,4'-tetrabromodiphenyl ether (BDE-47 CAS No. 40088-47-9) and 2,2',4,4',5-pentabromodiphenyl ether (BDE-99 CAS No. 32534-81-9) and other tetra and pentabromodiphenyl ethers present in commercial pentabromodiphenyl ether.

⁷ With the main congeners 2,2',4,4',5,5'-hexabromodiphenyl ether (BDE-153, CAS No: 68631-49-2), 2,2',4,4',5,6'-hexabromodiphenyl ether (BDE-154, CAS No: 207122-15-4), 2,2',3,3',4,5',6'-heptabromodiphenyl ether (BDE-175, CAS No: 446255-22-7), 2,2',3,4,4',5',6'-heptabromodiphenyl ether (BDE-183, CAS No: 207122-16-5) and other hexa- and heptabromodiphenyl ethers.

Hexabromobiphenyl (HBB) is listed in Annex A of the Convention. There is no specific exemption for its production or uses.

Routes of POP-PBDEs contamination

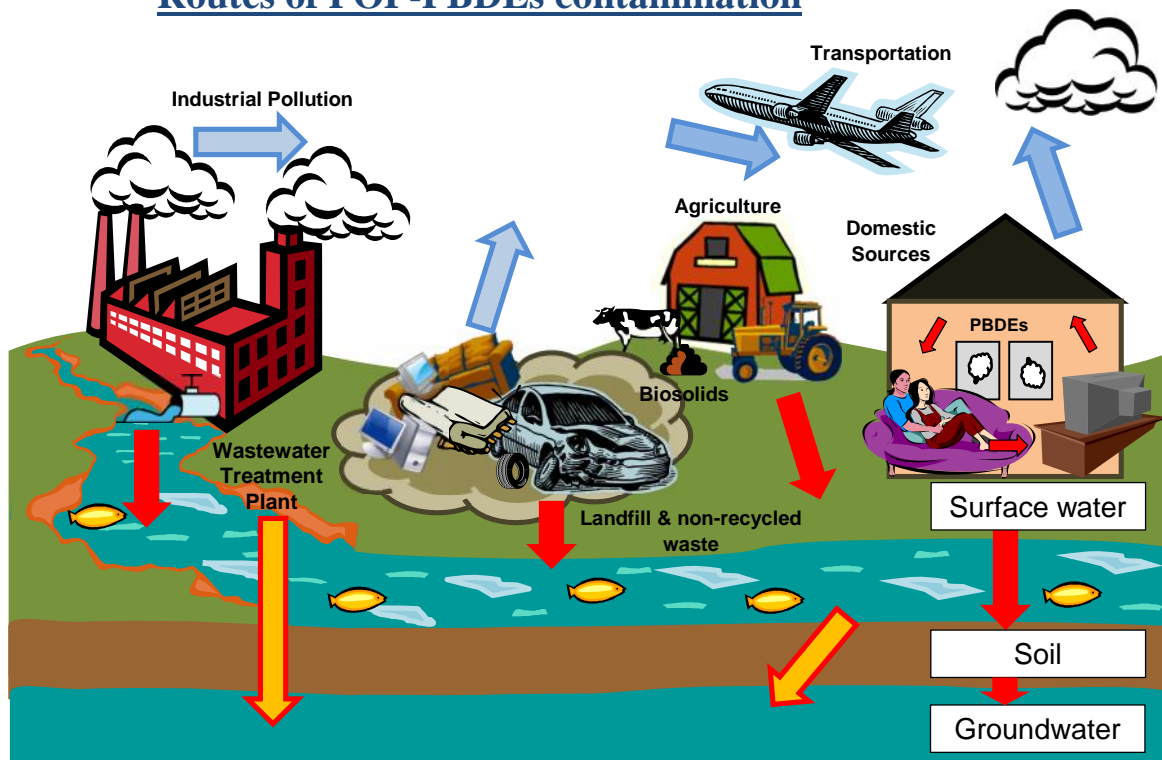


Figure 1.3.1:Routes of POP- PBDEs Contamination

1.3.1 Plastics from WEEE recycling and production of articles from recycled plastic

The mechanical recycling of plastic for further use is strongly favoured from a waste hierarchy and life cycle assessment perspective. When plastics are contaminated with POPs and other hazardous materials, however, particular care has to be given to how the waste hierarchy is followed. The recycling of WEEE results in a fraction of flame-retarded plastic, possibly containing POP-PBDEs. Some plastic from WEEE is sent to developing countries such as China and India where it is recycled into new articles. Recent studies have shown that plastics containing POP-PBDEs and other BFRs have been recycled in the production of articles for which no flame retardancy is required including children's toys, household goods and video tapes (Hirai & Sakai, 2007; Chen et al., 2009; Chen et al., 2010). This shows that the flow of plastics containing POP-PBDEs and other flame retardants for recycling are not well controlled and that plastics containing POP-PBDEs are being mixed with non-flame retarded polymers for the production of items with sensitive end uses. Therefore, in some cases, the use of recycled plastic may be significantly more hazardous than the original use (recycling from a printer housing into a toy that may be chewed by a child, for example).

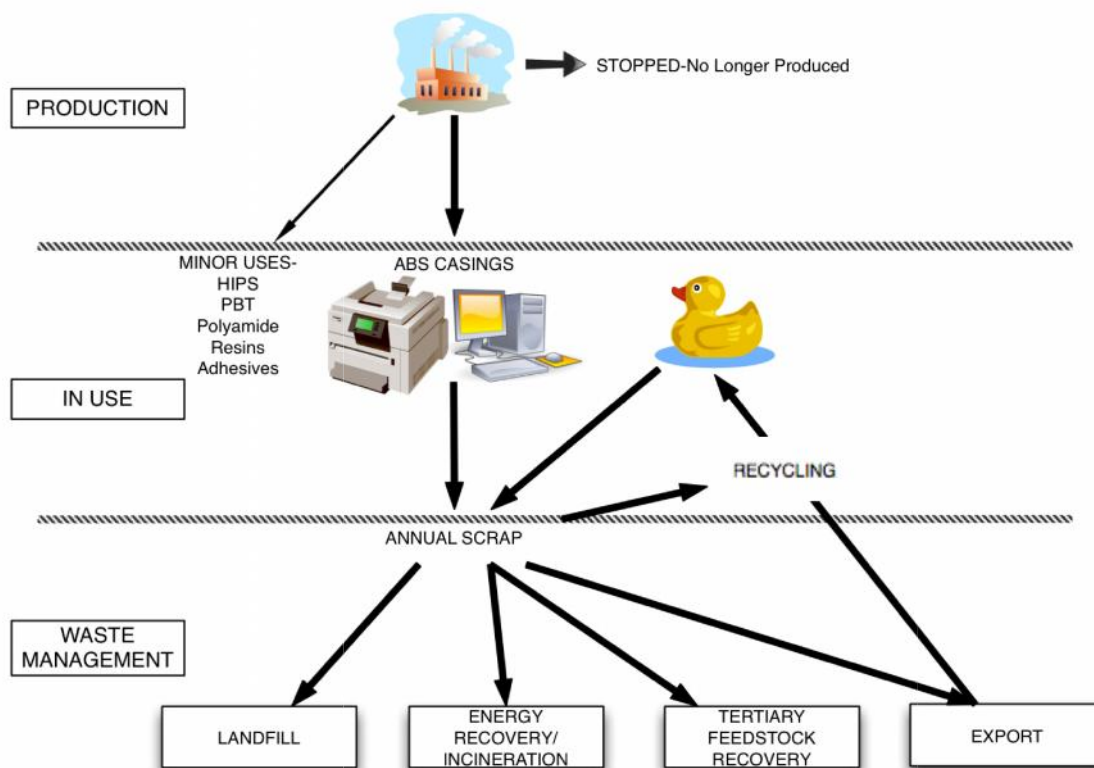
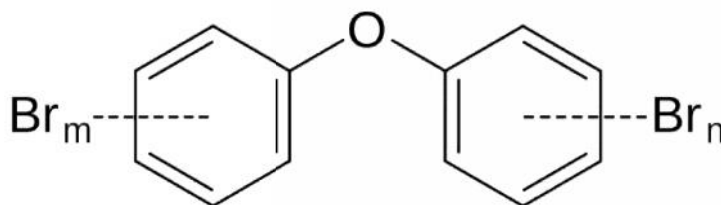


Figure 1.3.1.1: Schematic diagram of the life cycle of c-OctaPBDE and potential for emissions (adapted from Alcock et al., 2003)

1.4 POP-PBDEs and HBB in the Convention

Polybrominated diphenyl ethers (PBDEs; figure 1.4.1) are a group of industrial aromatic organobromine chemicals that have been used since the 1970s as additive flame retardants in a wide range of - mainly - consumer products. PBDEs were produced with three different degrees of bromination, and marketed as c-PentaBDE, c-OctaBDE and commercial DecaBDE (c-DecaBDE) (Alaee et al., 2003; Prevedouros et al., 2004; SFT, 2009). Although c-DecaBDE⁸ has not been found to contain POP-PBDEs, it can form POP-PBDEs by debromination during its life cycle, thus representing an important reservoir of POP-PBDEs (UNEP, 2010c; Ross et al., 2009).



The octaBDE, nonaBDE, and decaBDE homologues present in the mixture are not listed. These highly brominated PBDEs, however, can be degraded to POP-PBDEs by debromination (UNEP, 2010b, 2010c).

Figure 1.4.1: Structure of polybrominated diphenyl ethers (PBDEs)

The management and elimination of POP-PBDEs from the relevant material streams must be carried out in an environmental sound manner. The effective control of POP-PBDEs recycling and use of POP-PBDE-containing articles would require that we quantitatively have;

⁸DecaBDE can degrade in thermal processes, environment processes and in biota to lower brominated PBDEs including POPPBDEs (UNEP, 2010c). Other key degradation products are polybrominated dibenzofurans and, depending on conditions, polybrominated dibenzo-*p*-dioxins (Weber and Kuch, 2003; Ebert and Bahadir, 2003).

- i. Knowledge of the presence of POP-PBDEs in use and in unused equipment, in the recycling flows, or stockpiled for disposal in Kenya, identifying key stockpiles and major dealers.
- ii. The availability of appropriate recycling facilities and a labeling system marking the presence of POP-PBDEs and assessing whether the facilities are doing so as well as having capacity.
- iii. The availability of appropriate waste management systems; and end-of-life treatment; and finally;
- iv. Appropriate and effective monitoring and reporting of POP-PBDE-containing materials, equipment use, movement, sale, and disposal

1.5The 2007 NIP

This NIP did not consider the newly listed chemicals. Therefore the process of updating it will require an inventory of EEE (electrical and electronic equipment) and (waste of electrical and electronic equipment) WEEE produced, imported, exported and disposed in Kenya. These include electrical consumer goods such as electronic goods and equipment.

This report will show estimates of the production and importation of ICT equipment into the Kenyan market and the generation of e-waste in Kenya.

1.6Kenya Obligations under the Convention

Kenya will be in compliance if it takes measures to;

- a) To assess the presence and current uses of POP-PBDEs within Kenya and to understand the likely quantities, health and safety management, and the end-of-life treatment of POP-PBDE-containing materials.
- b) To determine the need for registration for the exemption on recycling and re-use if needed.
- c) To manage and eliminate POP-PBDEs from the relevant material streams in an environmentally sound manner considering the recommendations of relevant conference of Parties meetings on the elimination of brominated diphenyl ethers from the waste stream and from recycling.
- d) To integrate the activities on POP-PBDE management in the overall institutional management concept (re-use, recycling, and disposal) for material flows containing POP-PBDEs (e.g. electrical and electronic equipment/ waste electrical and electronic equipment (EEE/WEEE), transport sector, furniture, mattresses) and link these activities to the overall concept of sustainable production and consumption both at the public and private sectors.

2.0 OBJECTIVES AND METHODOLOGY OF INVENTORY

2.1 Objectives

The objectives of the Inventory are:

- a) To assess the presence and current uses of POP-PBDEs within the country and to understand the likely quantities, health and safety management, and end-of-life treatment of POP-PBDE-containing materials.
- b) To determine the need for registration for the exemption on recycling and re-use.
- c) To manage and eliminate POP-PBDEs from the relevant material streams in an environmentally sound manner considering the recommendations of COP5 on the elimination of brominated diphenyl ethers from the waste stream and from recycling.
- d) To integrate the activities on POP-PBDE management in the overall management concept (re-use, recycling, and disposal) for material flows containing POP-PBDEs (e.g. electrical and electronic equipment/ waste electrical and electronic equipment (EEE/WEEE), transport sector, furniture, mattresses) and link these activities to the overall concept of sustainable production and consumption.

2.2 The EEE/WEEE Inventory

Industrialization and globalization have increased the quantity and quality of goods that are produced and moved around the world mainly through trade. This has led to an increased generation of waste since due to availability; items are discarded with no real attachment or need for repair. For electrical and electronic goods, after use equipment is discarded in whole or in part. This section is a report on historical and current production, import, export, use, stockpiles and waste disposal for newly listed industrial POPs mentioned above. From the desk study and in analyzing the Kenyan situation, the following general conclusions can be made;

- a) Kenya is not a producer of any of the new POPs
- b) Kenya use in the processing and manufacture is not defined or quantified
- c) Kenya has no extensive documented import of EEE and there is an extensive use of pre used EEE not documented.

Because significant concentrations of PBDEs are found in CRT monitors of computers and TVs, the preliminary assessment was used to estimate the inventory of POP-BDEs EEE and WEEE.

This inventory and assessment provides has five chapters detailed below:

- i. A report providing details on the knowledge of the recycling, use, import, export, stockpiles, and disposal of electrical and electronic wastes.
- ii. Assessment of the legal, institutional, regulatory, and enforcement systems for management, recycling and end-of-life treatment of POP-PBDE-containing materials in particular EEE/WEEE.
- iii. Integration of the management of POP-PBDE containing articles and materials especially EEE/WEEE.
- iv. Assessment of the data gaps and deficiencies in the knowledge of POP-PBDE-containing EEE and WEEE material streams and their management.
- v. Identification and assessment of disposal and destruction options for POP-PBDE containing EEE and WEE articles and materials and a road map for environmental sound management.
- vi. Identification and assessment of possibilities for integration of the management of materials containing POP-PBDEs in the overall management (re-use, recycling, and disposal) of the POP-PBDE containing material flows (EEE/WEEE) considering the overall concept of sustainable production and consumption

2.3 Approach and Methodology

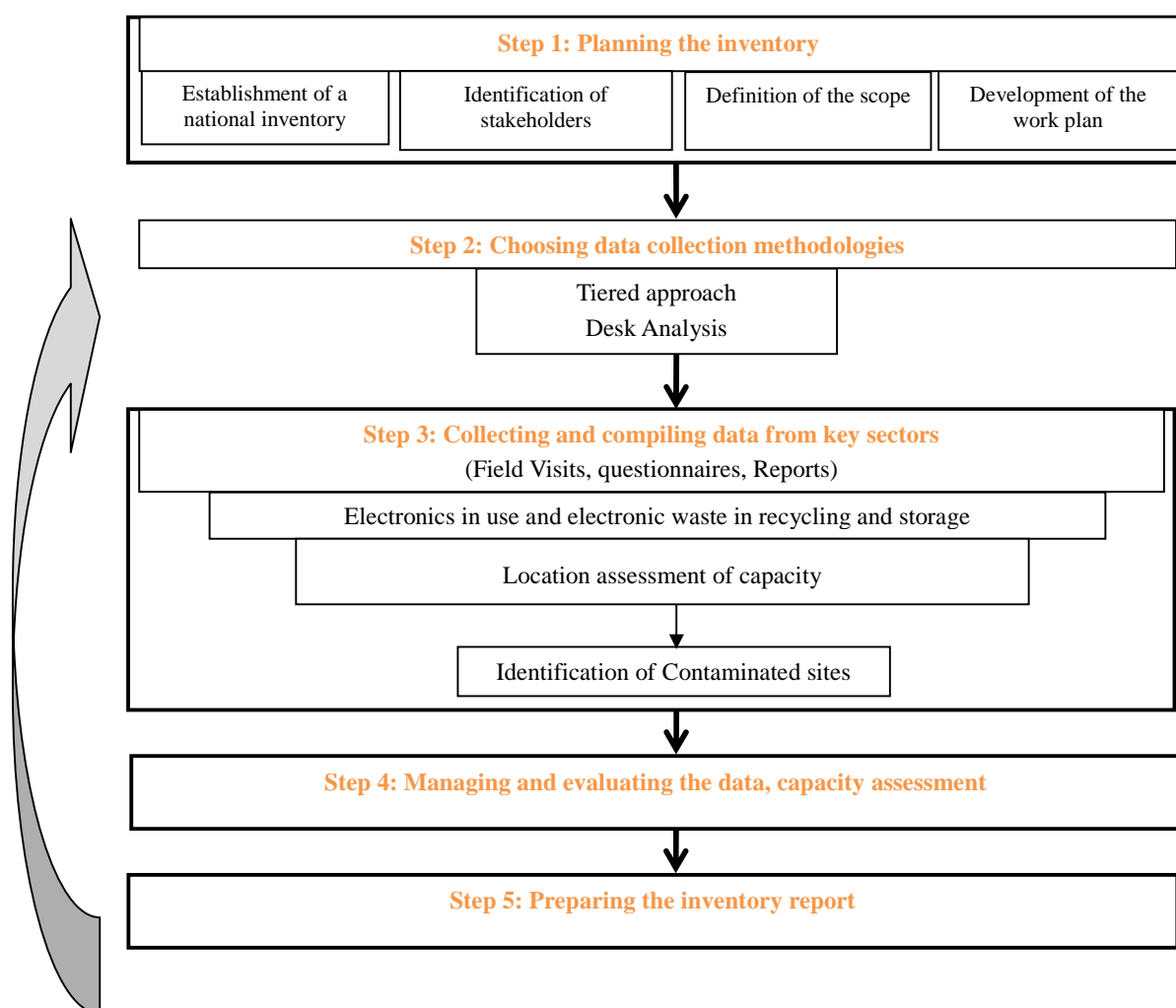
This inventory is in line with the guidance for reviewing and updating NIPS under the Stockholm Convention (SC) to list new persistent Organic pollutants (POPs). The process of updating the (NIP) to include newly listed POPs, involves inventory of EEE and WEEE. This inventory will give estimates of the production and importation of ICT equipment in to the Kenyan market and the generation of e-waste in Kenya. The key stakeholders of EEE and WEEE include importers distributes and retailers, consumers, refurbishes, collectors and recyclers. The focus is on ICT equipment in an attempt to estimate the inventory of POP –BDEs in electrical

and electronic equipment and waste of electrical and electronic equipment generated in Kenya. According to E-waste Management Regulations, 2013, EEE include;

- Large household appliances,
- Small household appliances
- IT and telecommunication equipment
- Consumer equipment
- Lighting equipment
- Electric and electronic tools
- Toys, Leisure and sports equipment
- Medical devices
- Monitoring and control equipment
- Automatic dispensers
- Batteries
- Security and military equipment, and fluorescent tubes

As per the guideline the inventory followed the following steps.

Figure2.3.1: Overview of the national POP-PBDEs inventory development process.



2.4 Planning the Inventory

The first step in the development of the POP-PBDE National inventory plan in EEE/WEEE is to define the scope of the inventory while involving the national relevant sectors for POP-PBDEs and objectives of the inventory and to develop a detailed work plan taking into account the following:

- a) Imports of new equipment
- b) Number of second-hand EEE imports in the inventory year(2011) and the previous years during which possible POP-PBDE containing EEE/WEEE were imported
- c) Stocks of EEE devices with possible POP-PBDE (content in use, stockpile and in the markets).
- d) EEE entering the waste stream WEEE

In the case of Kenya, an e-waste assessment focusing on ICT equipment emphasizing on computers and televisions has already been developed.

2.5 Identification of Stakeholders

The development of a national inventory of products and articles required cooperation of all stake holders of the WEEE/EEE with the relevant authorities in charge of manufacturers of consumer products, suppliers, retailers and the customs service, as well as other relevant authorities and organizations they included:

- a) Ministry of Environment, Water and Natural Resources for policy
- b) Ministry of Information Communication and Technology
- c) Kenya Power and Lighting
- d) Ministry of Trade
- e) Kenya Bureau of Statistics
- f) Mobile phone providers(Safaricom, airtel, orange, Yu)
- g) NEMA an authority in charge of waste management;
- h) Private Sector;
- i) Basel Convention focal point (and stakeholders in Basel activities on e-waste) ;
- j) Manufactures, Importers and exporters of electrical and electronic equipment ;
- k) Retailers of electronics and second-hand electronics;
- l) Recyclers of WEEE;
- m) Recyclers and users of polymers from WEEE;
- n) NGOs working on WEEE; NGOs working on POPs ;
- o) Other relevant stakeholders in the country.

2.6 Inventory Resources

The inventory used the following resources desk study, field work, team workshops and validation workshop. In addition the following resources were used.

- a) Basel convention guidance documents
- b) National publications
- c) National Statistics
- d) Workshops
- e) Field work Training materials forms to selected sites

Sources of information of information on this study are literature survey and personal communication.

Literature and statistical data on e-waste management practices, available technologies and community participation in e-waste management were collected from the internet. Specific reports databases, national statistics on census, press reports and publications from private sector stakeholders, were sources of data utilized in the study. National database for information assessed for the importation of EEE included:

- a. Data from the Waste Electrical and Electronic Center,
- b. Data from the Mombasa & Port-Customs
- c. Data from the Kenya bureau of statistics (KBS)
- d. Pictures during inspections and field visits

2.7Desk Study

The first tier—the “initial assessment”—involves a desk study to become familiar with POP-PBDE-containing articles:

- Getting an overview of the former uses of POP-PBDEs in articles;
- Collecting information about existing past and present national data on the import and use of POP-BDEs and articles containing POP-BDEs (and alternatives);
- and evaluating and verifying this information,

Key reference documents include;

- ICT Policy,2013
- Population census 2009
- PBDE Inventory guidelines
- Ewate guidelines
- Ewaste draft regulations

3.0 SITUATION ANALYSIS

The “preliminary inventory” involved site visits, desk research, and surveys to further estimate the national data that were identified as missing information in the initial assessment.

The third tier of the “in-depth inventory” was not undertaken. This tier could include site inspections; screening using X-ray fluorescence (XRF); and measurements of samples using liquid chromatography (LC) mass spectrometry (MS) mass spectrometry (MS) LC/MS/MS. This inventory is only preliminary

3.1 Choosing Inventory Tiers.

The key output that is important to updating Kenya NIP is to get the quantities of the POPs. For all three levels indicated in the inventory guidance were chosen.

- a) Tier1: Calculating capita stock⁹.
- b) Tier 2: From the developed detailed Kenyan EEE/WEEE inventory the EEE/WEEE data will be extracted which contains the information on POP-PBDE.
- c) Since Kenya is not producing any of the new POPs, the establishment of national impact factors In Kenya polymers from CRT and computers will be analyzing POP-PBDEs levels in WEEE Plastics.
- d) Establishment of a material flow assessment of CRT plastic and related substance flow of POP-PBDE were not done due to shortage of time.

This inventory is based on a 2011 as the base year.

The growth in early 2011 was fueled primarily by a healthy demand for notebooks, with Kenya showing the highest uptake. Early 2011 there was continuation of the dynamic development in 2010, supported by the resumption of commercial demand and strong advertising and promotion efforts by vendors, as well as their efforts to find new distribution channels and strengthen existing ones. This helped to stymie unofficial (gray market)¹⁰ shipments.

3.2 Projections

The public and private partnership will generate the growth of electronic waste. The ongoing Kenyan government and the World Bank initiated Kenya Transparency and Communication Infrastructure Project (KTCIP) continues to spur creation of digital villages in rural and urban areas, facilitating connectivity for the country's emerging business process outsourcing (BPO) industry, and accelerate e-government services. As 80 % of Kenya population is in rural areas, the potential for growth is astronomical. Other project initiatives that are being supported under the KTCIP include:

The Digital Villages Project - e-centers that provide a suite of services to the public via computers connected to the Internet, digital cameras, printers, fax machines, and other ICT equipment. Examples are;

- **E-government and Mobile Communications Project** - this entails the acquisition, deployment and maintenance of robust applications to be used for e-government initiatives, the government information portal, and support the development of SMS and IVR e-services.
- **E-government Applications** – will span growth as it involves digitization of the pension administration system, driver's license registration, and wealth declaration. It also includes the digitization of the High Court Registrar's office, Registrar of Companies, and the support of an Integrated Population Registration System (IPRS) and Land Information and Land Registration System. There will be more use for computers and computer accessories.
- **Government Information Portal** - aimed at strengthening the provision of information on the existing portal developed by the Ministry of Information, Communication and Technology¹¹ through the development of information services and web content. This will entail financing the purchase of web servers, internet bandwidth, computers and software.

⁹ Guidelines for E-Waste Management in Kenya , (NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY) December 2010

¹⁰ Grey Markets; Uncontrolled Markets also known as black markets

¹¹ www.information.go.ke

- **SMS and Interactive Voice Recognition (IVR)** - entails the development of innovative communication and information applications deployed on mobile phones via SMS and IVR technologies. Potential applications on the mobile telephony include early warning systems, data monitoring (e.g. weather station readings) and the provision of agricultural extension services.
- **Electronic tax collection (ETC)** initiatives are well underway with the majority of large companies in Kenya's formal sector (i.e. major retailers, hotels, etc.) already compliant. However, given the size and diversity of Kenya's informal economy, tax collection at point-of-sale in Kenya has grown significantly with introduction of Electronic Tax Registers. Most formal establishments risk severe penalties if found not to utilize ETRs. In January 2008, the government launched the system that will enable workers to file income tax returns online, has been piloting the project. Online tax returns for corporations are already ongoing and available.

3.3The ICT Market in Kenya

The ICT industry is one of the fastest growing business sectors in Kenya. EEE are used in the education, health, industrial, trade and communication sectors. The private sector has been installing heavy computing equipment and data centers (mainly ISPs), mobile operators, banks, and manufacturing sector companies.

Kenya primarily depends on import of all EEE i.e. brand of desktop computers, laptops and or notebooks as well as peripherals (keyboards, mouse's, screens, Printers and Scanners). Kenya imports 100% of its computers and peripherals, with a very small amount of assembly done locally. Some of the major Sources/ main vendors of ICT equipment being HP/Compaq, Toshiba, DELL, Sony, Acer, IBM and Apple

The market for used computers and peripherals is also significant with U.S. brands being brought into the country through Dubai. The market share for used computers is growing rapidly with the major end-users being primary and secondary schools, colleges, internet cafes, and households. Cyber cafes and even small scale businesses. The explosion will come when all institutions especially under the counties adopt e-government, truth based organizations such as churches embrace computers and funerals move to paperless management. The problem is that they have a short life span 0-3years. They then become too slow, outdated and obsolete.

3.3.1 Hardware:

The sophistication of the hardware is changing. For example, The Kenyan market preference for desktop computer systems is largely skewed towards Duo Core systems. The basic specifications are as follows: RAM – 1-3 GB; Hard Disk Drive – 80/120/160 GB; 17-inch monitor (LCD); USB Keyboard/Mouse; Onboard processor – 1.8 GHZ Duo Core and above. End user wants faster computers and larger storage. This however changes frequently as new computers and software's will become increasingly available and affordable. The end users' preference is increasingly changing with the adoption of newer technology. Below is an example of stacked second hand laptops in a retail shop in Nairobi.



Figure 3.3.1.1: Pre used computers at a retail shop in downtown Nairobi. (Picture by Mark Karanja)

Growth in the ICT Industry is growing as the market stabilizes. This is as a result of the complete removal of duties on computer peripherals in June 2006 as well as recent removal of duties on computer printers and ICT equipment. Enhanced GOK procurements related to its e-government projects (including the recent introduction of online tax returns and Laptops for schools initiative) are also expected to fuel growth in the use of ICT equipment hence the total e-waste load.



Figure 3: An illustration of Laptops for schools. A government initiative (Picture by Mark Karanja)

3.4.Generation of Electrical and Electronic Waste in Kenya

This high rate of accumulation of e-waste stems not only from the rapid pace of emerging technologies but also from e-waste disposal by developed countries in the form of used electronic equipment with short life-spans.

3.4.1.E-waste definitions; E-waste is a generic term encompassing various forms of electrical and electronic equipment that are old, end-of-life electronic appliances or have ceased to be of any value to their owners (UNEP). ¹²E-waste includes electronics which are destined for reuse, resale, salvage, recycling, or disposal. Figure 4 is such waste.



Figure 3.4.1: housing of Computer casing at a dumpsite: Picture by Mark Karanja

3.4.2 Import and Export of Electrical and Electronic Equipment(EEE).

The Information and communication technology expenditure (US dollar) in Kenya was reported at 1746019109.42 in 2008, according to the World Bank.¹³ Information and communications technology expenditures include computer hardware (computers, storage devices, printers, and other peripherals); computer software (operating systems, programming tools, utilities, applications, and internal software development); computer services (information technology consulting, computer and network systems integration, Web hosting, data processing services, and other services); and communications services (voice and data communications services) and wired and wireless communications equipment. This page includes a historical data chart, news and forecasts for Information and communication technology expenditure (US dollar) in Kenya.

a) ICT goods imports (% total goods imports) in Kenya

¹²Sustainable Innovation and Technology Transfer Industrial Sector Studies , Recycling – From E-Waste To Resources, (UNEP) July 2009

¹³UN Comtrade Data, World Bank

ICT goods imports (% total goods imports) in Kenya was last measured at 7.22 in 2010, according to the World Bank. Information and communication technology goods imports include telecommunications, audio and video, computer and related equipment; electronic components; and other information and communication technology goods. Software is excluded. This figure shows historical data and statistics for ICT goods imports (% total goods imports) in Kenya.



Figure 3.4.2.1: The ICT goods imports percentage of total goods imports in Kenya.¹⁴

¹⁴ITU World Telecommunication/ICT Indicators Database, <http://comtrade.un.org/db>

b) Personal Computers

Personal computers are self-contained computers designed to be used by a single individual. This page includes a historical data chart, news and forecasts for Personal computers in Kenya.

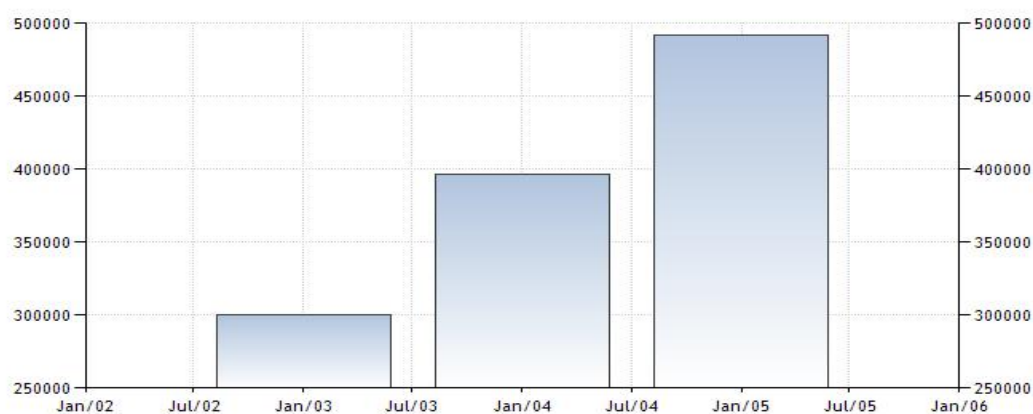


Figure 3.4.2.2 growth in trends in the use of personal computers use in Kenya

c) Mobile Handsets

The Population covered by mobile cellular network (%) in Kenya was reported at 83 in 2008, according to the World Bank. Population covered by mobile cellular network is the percentage of people that live in areas served by a mobile cellular signal regardless of whether they use it. This page includes a historical data chart, news and forecasts for Population covered by mobile cellular network (%) in Kenya.



Figure 3.4.2.3: Population covered by mobile cellular network (%) in Kenya

Table 3.4.2.4: Data containing the number of EEE in Kenya .Data is in quantities imported and the year

Year	TV and CRT's	Radios	Mobile phones	Computers	Printers	Refrigerators
2005	Data unavailable	443538	4,611,970	443538	17711	339456
2006	Data unavailable	420406	7,340,147	420406	1802	376225
2007	38063	665471	11,349,412	665471	62533	519130
2008	81042	512894	16,303,573	512894	80712	517832
2009	84403	774457	19,364,559	774454	2641840	389806
2010	126270	1169847	24,968,891	1169796	160773	764234
2011	105210	1169796	28,080,771	1169796	162215	617121
2012	110671	1514734	30,731,754	1514734	189396	1029772

Table 3.4.0.5 Average weight of EEE imported from 2005 - 2012

Year (2005–2012)	TV and CRT's	Radios	Mobile phones	Computers	Printers	Refrigerators
Average Number	90943.1667	833892.9	17,843,885	833886.1	414622.8	569197
Average Weight In Tonnes	2273.58	4169464	1784388.463	20847153	3316982	25613865

Average number = (total no. of electrical and electronic equipment)/8

Average weight = (Average number) * (average weight of one EEE)

3.5 Historical Generation Of Disposable WEEE

It is important to understand the steps leading to generation of WEEE. An estimated 50 million tonnes of e-waste is produced globally each year with Kenya generating an average of 3,000 tonnes e-waste from personal computers, monitors, Walkman, iPods, mobile phones, mp3 players, computer gaming items, keyboards and mice; printers, copiers and scanners; vcrs, stereos; networking hardware, disk drives; servers and mainframes, audio/visual equipment, computers manuals; software, television; telephones, fax circuit boards, cable and satellite equipment, computer cables and wires. Electric and Electronic Equipment

In a study carried out in 2007 by Kenya ICT Action Network¹⁵ showed that: 1,513 tonnes of electronics entered the market. The consumer in addition to receiving 1,489.4 tonnes also received 151.3 tonnes from the second hand market. Kenya has reached a mobile penetration rate of more than 63% and an internet penetration of more than 18.6%. The number of internet users was estimated at 10.2 million

In an assessment done by UNEP (2009) and subsequent press release (2010)⁹ estimated that annually, Kenya generated e-waste in the following forms:-

- 11,400 tonnes from refrigerators,
- 2,800 tonnes from TVs,
- 2,500 tonnes from personal computers,
- 500 tonnes from printers and
- 50 tonnes from mobile phones.

Note: This must now have increased.

¹⁵Kenya ICT Action Network (KICTANet) (2008) *E-waste Management in Kenya: A baseline study*. www.kictanet.or.ke

Table 3.5.1: The estimated weight and life cycle of electrical and electronic equipment.

Electrical Equipment	Life time in years	Weight in kgs
PC+ Monitor	5-8	25
Laptop, batteries,chargers,	5-8	5
Printer	5	8
Mobile Phones	4	0.1
TVs	8	30
Refrigerators	10	45

In 2008 Kenya hosted the 8th Meeting of the Conference of Parties To the Basel Convention it noted that:

There has been an explosion in the use of consumer electronics in Kenya. This includes:

- Due to limited access to disposal facilities, some institutions stockpile on their old electronic equipment and auction them off to members of staff. Some have also established a Computer Donation Program to primary schools in rural areas.
- Access to the Internet and International communication has become quite easy. The introduction of Voice over Internet Protocol (VoIP) has reduced the charges on international calls drastically. With the growing number of Kenyans in the Diaspora, these services have acquired increasing popularity. Cyber café have mushroomed in many urban and rural areas. This has lead to an increase in the number of computers in use. Cyber cafes around Nairobi and other urban areas are simply storing their old unusable computers in whatever available space they have.
- The entertainment industry is also experiencing a tremendous growth spurt. The number of FM radio stations has increased from three in the 1990s to over twenty currently. The number of television stations has also increased in the same period from two to over ten and ease of access to such cable companies as DSTv. This has lead to increase in number of Radios, Stereos and Televisions in use across the country. Moreover, many *matatus* (public minibuses) and private cars are now outfitted with sophisticated car stereos and DVD players. There has been an influx of cheap DVDs, VCDs, and MP3s fuelling the purchase of DVD/VCD players, Mp3 players and other accessories.
- Mobile telephony is the fastest growing industry in Kenya today. Increasingly lower rates of communication coupled with the reduced prices of mobile phone technology, has made mobile phone communication accessible to many Kenyans in almost all regions of the country. Government statistics reveal that the telecommunications industry experienced a 56.4% growth in the year 2005. Mobile subscriber numbers increased by 40.6 per cent within the same period.
- Mobile Phone Repair shops in urban areas are buying dead phones as sources of spare parts

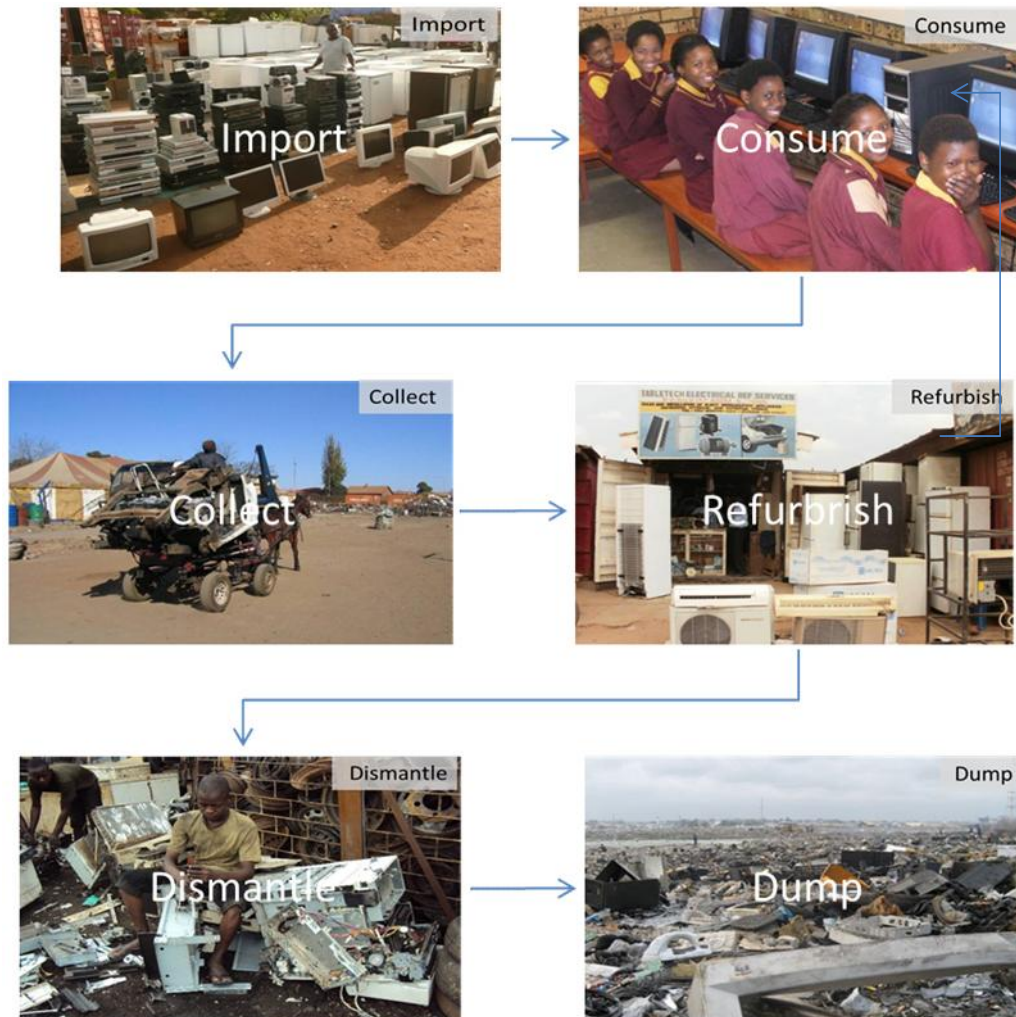


Figure 3.5.2: The Life Cycle of Electrical and Electronic Equipment

3.6 Sources of WEEE in Kenya

3.6.1 Institutional sources

This inventory found out that e-waste is on the rise in Kenya and this can be attributed to the rapid changes in technology: a key example is the change from analogue to digital television sets in Kenya and the new mobile phone innovations that are released in quick succession; SII then SIII Galaxy into the Kenyan market, changes in media such as software (from Windows 7 to Windows 8) and the move from the Video cassettes to DVD's and MP3 players and finally the falling prices of technology. E-Waste is generated by various sources including:

- Government offices,
- Private businesses and Corporations,
- Manufacturing concerns,
- Municipalities and Counties,
- Non-profit organizations,
- Learning institutions,
- Computer assemblers and retailers,
- Recyclers and Refurbishers,
- Foreign embassies,
- Secondary markets for pre-owned computers and
- Relatively affluent households.

Key Sources are described below:

- i. Refurbished Computers: A number of businesses sell equipment, run cyber-café's and mobile phone shops in the informal sector. The sector is not completely regulated and tends to use simple technologies and employ a large number people. The ease of entry and exit into this sector, coupled with the use of low-end technology, makes it an easy avenue for employment creation and small business development (CBS, 2007).
- ii. As of February 2006, there were 5,729,501 subscribers on the cellular networks. According to the latest statistics report published by the Communications Commission of Kenya for the July to September 2012 quarter, the number was 30.4 million (the number based on active SIM cards). In the early years (1998-2002) the cost of handsets and the demand for service were both high. This situation encouraged the mass importation of second-hand handsets, which are comparatively cheaper.
- iii. Both the computer, the mobile phone, tables are all users of internet. A study carried out by CCK estimated the number of Internet users to be 2.77 million people in 2006/07. This number by December-31-2012 was 16.2 million. Cyber-café's operate with five to 100 computers, most of which are second-hand. According to Communications Commission of Kenya (CCK)¹⁶ statistics published on its website by 2004/5, 90 cyber-café's had registered with them, which is an increase of 57% from the previous year.

There are many ways to dispose off old and obsolete equipment. These include:

- i. For large corporations they advertise and sell to the general public as second hand equipment
- ii. Some sell to general merchants that deal in metal parts and plastics
- iii. Equipment is dropped at garbage collection points
- iv. Donation and re-use (e.g. Computer for Schools Kenya)
- v. Store equipment in a room in the building (e.g. office storeroom)
- vi. or give away or sell to friends and family

3.7 Case Study

3.7.1 Computer For Schools Kenya

Computers for schools Kenya also known as CFSK is an NGO established in 2002. CFSK has sourced over 100,000 personal computers that have been deployed in over 8,500 Public secondary and primary schools, technical training institutes, teacher training colleges, medical training centres and several universities. In a number of institutions, they have also placed electricity generators, internet access and the world space direct media service. CFSK main activities are the servicing and conducting comprehensive preventive and curative maintenance programme for computers to ensure computers are fully operational all the time. CFSK also provide technical support and maintenance services as well as Networking Service, by providing competent and experienced team of networking professional. CFSK supplies all major brands of ICT Equipments at cost-recovery basis-giving our clients value for money. All equipment supplied by CFSK comes with a standard return-to-base warranty. Post-warranty. These ICT equipment include:

- Branded New Computers – PC and servers
- Branded brand new lap tops and laptop servers
- Branded refurbished re-owned computers
- A wide range of new and refurbished medium heavy duty printers.
- LCD projectors for both standard classroom use as well as conference style presentations.

Sourcing for Electronic Equipment

Source of ICT equipments are local and international institutions. All are from donations and not purchased. In order to discourage 'dumping' of electronic equipment. There is a criterion for the computer they can receive. Minimum processor is Pentium IV and above. If locally donated. If computer or ICT equipment is sourced from outside then the computer must not be more than four years old.

¹⁶ www.cck.go.ke

In 2002 CFSK had a take back scheme whereby they would collect pre-owned ICT equipment these are old absolute equipment and exchange with newer versions. From 2006 they began accepting equipment from anyone else apart from learning institution including the East African region.

Countries in overseas which donate Computers to CFSK include: Belgium, Netherlands and UK, Norway, Sweden Canada and USA. CFSK only accept brand equipment i.e Dell, HP, Compaq, IBM, Lenovo etc. That way it will thus guarantee quality of Electronic equipments.

To encourage institutions to up-grade their laboratories while at the same time conserving the environment and public health, CFSK has a special offer that allows clients to trade in their existing computers for value – deductible from the cost of new computers acquired from them. Their technical staff assesses and value the older equipment for this purpose and a price for the same is mutual agreed upon. In this way, CFSK relieves the client of the challenge of disposing off the older and decommissioned equipment following an upgrade of their facilities.

Procedure for refurbishing ICT equipment

1. For local donations CFSK receive bulk ICT electronic equipments from WEEE Center. These are ICT equipment that have passed the criteria first phase and are in good working order. The computers are sorted and tested so as to be categorized to computers that are working and do not working. One that are not working are returned to the WEE Center.



2. Once the ICT equipment are received from bulk sources they are inventoried the second phase of the process undergoing an activity called ghosting whereby they are store.
3. Once the computers are ghosted,¹⁷ they are cleaned. This process involving blowing off of dust the CPU, cleaning of computer mouse and Keyboard as well as the Monitors and the ICT equipment.
4. Once they are pass the last stage they are assembled and dispersed to Public Secondary and Primary Schools, Technical Training Institutes, Teacher Training Colleges, Medical Training Centres and several Universities.

3.7.2 Kariokor Market

Kariokor market is one of the markets where one can purchase second hand or used electrical and electronic equipment. It is located on. The different types of Electrical and electronic equipment found in this market include:

1. **Small appliances;** Irons, kettles, hair dryers, electric heaters Remote controllers, Mobile phones, Radios, MP3-players
2. **Medium Size Appliances; Vacuum** cleaners, refrigerators and freezers, Washing machines, spin and tumble dryers, microwave ovens, DVD player/recorder, CRT TVs, Blenders and juicers, Heaters, Fans,

¹⁷ Ghost imaging, using ghosting software, is a method of converting the contents of a hard drive -- including its configuration settings and applications -- into an image, and then storing the image on a server or burning it onto a CD. When contents of the hard drive are needed again, ghosting software converts the image back to original form.

3. **Larger Appliances;** Electric Cookers, Fridge/Freezer, Electric and Gas Ovens, washing machines, Hi-Fi systems, Boilers,
4. **ICT Hardware;**Desktops, CRT Monitors, printers, UPS Battery systems,
5. **Electrical Cables and wiring (copper Based cables)**



My observation was that different entrepreneurs feel that for every electronic product created they do not look too much on the life expectancy that is the length of time a product would reasonably be expected to be, rather whether the device can be repaired economically and where the spare parts are available. Some cosmetic parts may not be available for the same period of time as functional parts. Sourcing for electronic equipment from everywhere,



3.7.3 Coastal Region

In Mombasa, site visits were limited to second hand computer shops, warehouses (go-downs) and dumpsites Mombasa the second-largest city in Kenya, with a population of over one million. Mombasa has a large port and an international airport, and is an important regional tourism center. Mombasa covers an area of 113.8 sq miles (294.7 km²). Our method of method of site visits was random sampling. At first we had identified a large number of second hand and refurbished hand electrical and electronics shops, as well as recycling sites that doubled up as scrap yards.

However on site due to the time constraint we identified one major refurbished computer shop and from the operator of the shop I got a list of other major shops and warehouses which deal with the importation and sale of second hand as well as refurbished electrical and electronic equipment. Most of the major shops were situated in office blocks or plazas. We visited the following sites in the town:-

- Electrical and electronic equipment's retail Distributors
 1. Yusuf Ali Mansion Moi avenue; Ace dot Comp
 2. Ace dot Computers Yusuf Ali Mansion, Ground Floor Moi Avenue, Mombasa
 3. Spaceman IT Mart is located at Ground Floor, Motormart Building, Moi Avenue
- Second hand ICT retailers and refurbishes
 1. Euro Used Electronics General store, Jomo Kenyatta Avenue
 2. HARNESS-TECH SYSTEMS Yunis Floor; Ground
- SabaSaba stalls and warehouses

Within Mombasa town there are a large number of new and second hand/refurbished computer retail shops of

which we visited three. There were more shops within the town Centre however we were more interested in the shops with a capacity of not less than 100 computers at a time. I also visited two retail shops which sell all manner of second hand electrical and electronic equipment. We also visited an informal shop which sold refurbished refrigerators and air conditioners.

The main methods of data collection were interviews and observation and the use of photography. The interview questions were guided by draft copies of the questions in the guide; 'Guidance for the inventory of polybrominated diphenyl ethers (PBDEs)' listed under the Stockholm Convention on Persistent Organic Pollutants.

Observation:

Mombasa has three major formal of computer shops that deal with the importation and sale of second hand refurbished computers. Majority are Informal. This includes desktops, monitors, laptops, printers and computer accessories such as mouse and keyboards. Most of the shop owners and attendants were not cooperative at first however after we explained what our main purpose for the visits was they would cooperate but just to a certain extent. Picture taking was very limited however through verbal interviews and observation I was able to get the data required. Some of the owners were interested in being involved in the survey for the NIP because they dealt more in the refurbishing of second hand computers.

Primarily all the shops that we visited had the same story whereby the owners would begin by the purchase of second hand equipment in bulk from the warehouses or import in containers. A container can contain around 500 -1000 computers faulty computers or parts. Depending if it's a 20 foot or 40 foot container.



Fig. Container packed with pre-used computers just imported at KPA Mombasa



Fig. Used computers being sorted out

The second step is sorting into unusable and reusable computers and computer parts and inventory is conducted. The unusable computer and computer parts are discarded by selling to scrap dealers. The frequency of purchase of new shipments of ICT equipment from the warehouses or importation depended on the rate of sale of the recycled or refurbished computers.

The shop owners i visited confirmed that most of the ICT equipment brought into Kenya originate from USA and the UK. However even after buying the computers from the warehouses or imported computers one would find a percentage of the bulk equipment to be faulty. For example Euro Used Electronics General store, which deals assorted working refurbished electrical and electronic equipment approximated that over 15 percent of what is bought is faulty and non-recyclable junk. They would dispose it by either selling to scrap dealers, give away as waste collection who would in turn take to dumpsites.



Fig. Faulty no - recyclable ICT equipment ready for disposal to dumpsites

Upon further investigation on awareness any health implications of the wastes, the burning and the dumping, from the sites I visited I noted that very few of the respondents expressed strong knowledge on the harmful smoke during burning or the dangers of the Electrical and electronic equipment components if not properly

disposed of. E-waste is not closely monitored by the government in fact Kenya has not developed a law specific to govern e-waste or developed a proper e-waste disposal system.

In Mombasa I visited a number of refurbishing shops whereby the main Electronic equipment the refurbished were refrigerators and air conditioners. I also visited shops (Euro Used Electronics General store) that primarily deal with the importation of second hand used electrical and electronic equipment. The shop owner responded that he imports one container every sixth to seventh month and also added that for the major importers who own warehouses would import collectively over 50 containers of refurbished containers imported each year.

As was observed earlier in the interviews the second hand business owner confirmed that out of the total number of electronic equipments at most 20% is faulty and cannot be refurbished or recycled. The mostly import from Europe and USA. The first step is usually trying to repair and recycle the faulty machines within the shops, however the owners prefer selling the faulty machines to those specializing in repairing or refurbishing in faulty machines to recycle them at their retail shops and later sell the nonrecyclable parts to scrap dealers.



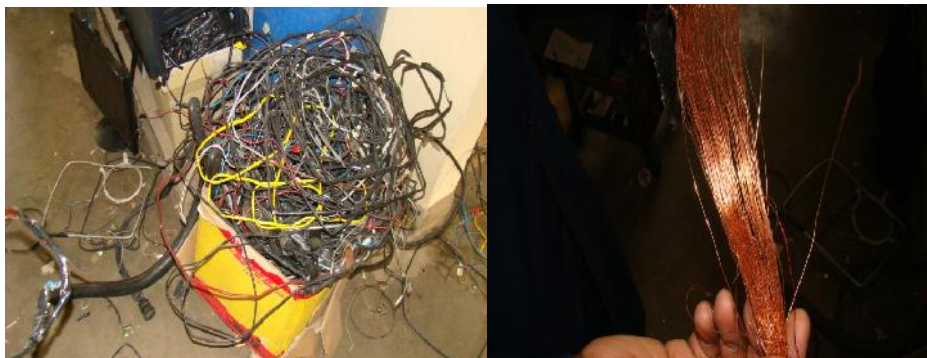
Sorted out consumer products



Household appliances already sorted out

A number of scrap dealers were identified and confirmed by the respondents. Retail shop owners and refurbishers say that the non-recyclable parts end up in the scrap yards. The Scrap yards are very insecure with scavengers hungry for money. I did not go to many scrap yards due to lack of time and capacity. However, a clear picture of how the wastes end up in the dump sites need to be given.

scrap dealers collect unusable electronic and electronic equipment so as to extract valuable elements such as copper, aluminum and others from the waste.



CONCLUSION

- The sale of second hand electrical and electronic equipment's especially ICT equipment, refurbished computers have picked up in 2006 when the government removed Value Added Tax (VAT) on computers.
- Digital boom is growing in Kenya and east Africa though not at the rate experienced in other countries.
- Business has developed in Kenya at a fast rate since the year 2003 and last year 2006 was the turning point when the VAT on computers was removed.
- However there is a limit to the people awareness on the dangers of second hand Electrical and electronic trade and of the e waste that results from it.

3.2Tier1: Inventory approach: Using CRT per capital data

The POP-PBDE inventory guidance suggests that for the preliminary inventory, a country that has not established any EEE/WEEE inventory can utilize EEE/WEEE data of other countries from the region and extrapolate the per capita value to a reasonable estimate for their own country. For this approach CRT monitors containing the largest share of POP-PBDEs in EEE/WEEE (PBDE inventory Guidance, Stockholm convention 2012)¹⁸ are used for simplification. Based on the considerations that states:

- The average weight of the CRT (TV or PC monitors) is 25kg per device
- And the polymer content is 30%
- The penetration rate (Number of CRTs/capita)
- And the average c-OctaBDE content, for CRT from TV is 0.89kg/tonne of plastic and computer is 2.54 kg/tonne of plastic (Table 4-11 of PBDE Inventory Guidance⁴).The POP-PBDE content in the CRT monitors can be calculated then, with known data of the population in the country and the given range of POP-PBDE values in computer CRTs.

¹⁸ Stockholm Convention (2012) Guidance for the inventory of commercial Pentabromodiphenyl ether (c- PentaBDE), commercial Octabromodiphenyl ether (c-OCTABDE) under the Stockholm Convention on Persistent Organic Pollutants

4.0 THE LEGAL, INSTITUTIONAL, REGULATORY AND ENFORCEMENT SYSTEMS FOR PERSISTENT ORGANIC POLLUTANTS (PFOS, PFOSF AND PBDES).

4.1 Guidance from the Convention

E-waste management should always be in compliance with applicable laws and regulations, but laws are sometimes difficult to find and understand, and will change from time to time. Therefore, a systematic approach will be the best way to regularly identify applicable laws and regulations, including amendments and new laws, and to determine how these requirements specifically apply to the facility and its operations. Publications, newsletters, government websites and industry associations may be valuable sources of information.

- The Basel convention and Bamako conventions recommend that signatories ensure that the generation of hazardous waste and other waste within a country are reduced to a minimum, taking into account social, technological and economic aspects.
- When Kenya is exporting hazardous waste and does not have the technical capacity, necessary facilities or suitable disposal sites to dispose of the waste in question in an environmentally sound and efficient manner, steps must be taken to minimise pollution and its consequences for health.
- Material recovery and recycling facilities must meet all local, county, and national laws and regulations that pertain to their operations
- They must be licensed and permitted by all appropriate governing authorities in their country.
- Licensing and permits should be consistent with governmental, regional and local regulatory requirements. Specific permits required may include: storage permit, air emissions permit, water permit, hazardous waste permit, and those permits required to meet landfill and other disposal regulations.
- Processes should be in place to ensure continued compliance with the requirements of the permits.
- All laws pertaining to occupational health, safety and rights must be complied with, as well as those pertaining to releases of pollutants to the environment.

4.2 National legal regime

Currently, ICT issues are considered under various legislation including: The Science and Technology Act, Cap. 250 of 1977¹⁹, The Kenya Broadcasting Corporation Act of 1988 and the Kenya Communications Act of 1998, which are inadequate in dealing with issues of convergence, electronic commerce and e-Government.

The current legal and regulatory regime is as follows:

- i. The Environmental Management and coordination Act (EMCA)
- ii. The Local Government Act
- iii. E-Waste Draft Regulations 2012
- iv. E-waste Draft Guidelines (NEMA)

There is need for a comprehensive policy, legal and regulatory framework to:

- a) Support ICT development, investment and application;
- b) Promote competition in the industry where appropriate;
- c) Ensure affordability and access to ICT nationally;
- d) Address issues of privacy, e-security, ICT legislation, cyber crimes, ethical and moral conduct, copyrights, intellectual property rights and piracy;
- e) Support research and development in ICT; and Develop action plans to address the changed status and new obligations

5.0 Action Plan

5.1 International Cooperation

¹⁹[http://www.kenyalaw.org/Downloads/Acts/SCIENCE%20AND%20TECHNOLOGY%20ACT\(Cap.%20250\).pdf](http://www.kenyalaw.org/Downloads/Acts/SCIENCE%20AND%20TECHNOLOGY%20ACT(Cap.%20250).pdf)

- a) Kenya sources of imports (Dubai, China, Malaysia etc.) should facilitate the transfer of technology to the developing countries that the people may establish better industries for recycling the computers and other electronics. This will go a long way in helping alleviate poverty by creating employment opportunities and achieve many of the Millennium Development Goals. Moreover, this will aid in strengthening the environmental regulation on hazardous wastes in these countries, thereby improving health and lives in general. For instance the 'reverse production' system creates infrastructure to recover and reuse material contained within e-waste. Businesses could pay electronic recyclers to haul away the old equipment and dismantle it. If it is done right, everything electronic can be reused except the casings which are often not reusable.
- b) Manufacturers of electronic goods, who have benefited from sales of their products, should take responsibility for them from production through to the end of their lives. Polluter pays principle should be applied.
- c) To prevent an e-waste crisis, manufacturers must design clean electronics with longer lifespan, that are safe and easy to recycle and will not expose workers and the environment to hazardous chemicals.
- d) Electronics manufacturers should stop using hazardous materials. In many cases, safer alternatives currently exist.
- e) Manufacturers of electronic products should come up with a maintenance infrastructure in developing countries such as Kenya.
- f) Manufacturers should consider establishing a Take Back policy for the End of Life products.
- g) Mechanism should be put in place to encourage manufacturers and service providers/outlets to establish Take Back program with incentives

5.2 National level

- a) Start operationalising the ewaste guidelines
- b) Creating public awareness on electronic waste and the hazards posed by unsafe disposal.
- c) Government through NEMA should re-commit sound management and sustainable use of chemicals with the objective of reducing exposure to the harmful effects of chemicals in electronic equipment through the prevention and reduction of anthropogenic releases in the environment. This can be done through strengthening information exchange and networking infrastructure to facilitate chemical information dissemination and contributing to the establishment of new ones.
- d) The government should work towards strengthening the national and regional programmes on sound management of chemicals and hazardous wastes in electronics.
- e) The government should adopt stringent regulations on the goods being imported in terms of setting a time frame for the phasing of toxic chemicals e.g. brominated flame retardants in electronic equipment.

5.3 At County level

Specific activities of such programmes include:

- a) Working with partners to establish and strengthen sub-regional accreditation for analytical laboratories within.
- b) Establish information exchange and networking infrastructure to facilitate hazardous waste information dissemination.
- c) Each county director ensures implementation of guidelines and regulations on management of electronic waste.
- d) Avoid open burning of waste
- e) Retailers of electronics should be encouraged to set up a Take Back program in conjunction with recyclers and/or manufacturers. Discount vouchers for users' next purchase of electronic equipment could be offered.

5.4 Role of communities

- a) Consumers of electronics should take responsibility for their electronic waste by separating it from other waste and subsequent safe disposal. They should ensure that Electronic waste does not find its way to the dumpsite where it may be subjected to open burning.
- b) Consumers should be provided with sorting out facilities to enable households not to mix e-waste with ordinary municipal waste.
- c) Establish safe disposal methods for obsolete electronic equipment
- d) Establish public/private sector partnership in e-waste management.
- e) Encourage investors in the e-waste management sector

6.0 RECOMMENDATIONS.

To ensure that POPS do not enter the environment then the following should be undertaken.

Policy Options

- i. Invest in enforcement
- ii. Require all 'legal' shipments of used EEE to be properly packaged
- iii. Restrictions – only after implementing previous policy options
- iv. Prohibit e-waste imports
- v. Partial ban based on age and product type
- vi. Certified Reuse Channels, Material recovery, energy recovery and disposal facilities should be properly authorized and licensed, and comply with all applicable laws – local, national, regional, multilateral and international.
- vii. It is very important that end-of-life computing equipment be collected effectively (which is usually not the case today, even in industrialised countries).
- viii. Funding for collection should be arranged and provided where necessary by county Governments.
- ix. Environmentally sound material recovery and recycling of end-of-life computing equipment requires setting up an effective recycling chain, comprising the steps of robust collection of used computing equipment, evaluation, testing/refurbishment/reuse. The CFSP should be given additional support
- x. ESM recycling facilities should ensure that computing equipment and materials derived from it are only managed in environmentally sound management facilities that are licensed and permitted to manage these materials.

REFERENCES

Sustainable Innovation and Technology Transfer Industrial Sector Studies, Recycling – From E-Waste to Resources, (UNEP) July 2009

E-waste Management in Kenya: A baseline study Kenya ICT Action Network (KICTANet) (2008)

Guidelines for E-Waste Management in Kenya, (NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY) December 2010.

National ICT Survey Report, (Communication Commission of Kenya & Kenya National Bureau of Statistics) 2010

Quarterly Sector Statistics Report First Quarter Of The Financial Year 2012/13, (Communication Commission of Kenya) July-September 2012

Analysis of 2010 ICT Survey, (Communication Commission of Kenya), 2010

Guidance for the inventory of commercial Pentabromodiphenyl ether (c- PentaBDE), commercial Octabromodiphenyl ether (c-OCTABDE) under the Stockholm Convention on Persistent Organic Pollutants, (Stockholm Convention) 2012

<http://idc-cema.com/eng/about-idc/press-center/41192-pc-shipments-in-east-africa-record-massive-growth-in-q1-2011-according-to-idc>

<http://www.knbs.or.ke/> (Kenya National Bureau of Statistics)

<http://www.information.go.ke>

http://www.pops.int/documents/convtext/convtext_en.pdf

<http://www.cck.go.ke>

<http://www.kictanet.or.ke>

ANNEXES:

Annex1. TERMS OF REFERENCE

1.1 Tasks under NIP consultancy

The tasks under this consultancy requires that among other things

- i. Address new obligations under the Convention focusing on relevant changes that touch on above mentioned newly listed POPs, namely PFOS and related substance PFOSF, and the brominated flame retardants (POP-PBDEs) used in EEE and WEEE.
- ii. Assessment of the implementation of action plans (e.g. changes regarding the production, import, export and disposal of used in EEE and WEEE, related changes in the legal framework and institutional infrastructure)
- iii. Address action plans to address the new obligations.
- iv. Indicate how Kenya will address Article 15 of the Convention² 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

0.2 Outputs

- i. A Report on historical and current production, import, export, use, stockpiles and waste disposal for newly listed industrial POPs mentioned above (PFOS, PFOSF and PBDEs).
- ii. A detailed account of the legal, institutional, regulatory and enforcement systems for the above named POPs pesticides.
- iii. A detail account of the data gaps and deficiencies in the knowledge on POPs pesticides mentioned above.
- iv. Presentation of elements to develop an action plan to address pesticides in the context of the NIP.
- v. Indicate how Kenya will address Article 15 of the Convention² 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.

Annexes

Annex 1. List of E-waste inventories from developing countries

In several developing countries EEE/WEEE inventories according to the “EMPA” methodology have been conducted (see table below). The related reports are also available in the internet online (selected under <http://ewasteguide.info/ewaste/case-studies>)

Country	Year	Focus ¹⁾	Programme	References
Benin	2010/11	Categories 1-4	Basel Convention	Aina et al. 2011
Burkina Faso	2010/11	Categories 1-4	PACE	PACE 2011
Côte d'Ivoire	2010/11	Categories 1-4	Basel Convention	Messou et al. 2011
Ghana	2010/11	Categories 1-4	Basel Convention	Amoyaw-Osei et al. 2011
Nigeria	2010/11	Categories 1-4	BaselConvention	Ogungbuyi et al. 2011
Tanzania	2010	Category 3 & 4	UNIDO	Magashi et al. 2011
Uganda	2008	Category 3 & 4	UNIDO	Wasswa and Schluep 2008
South Africa	2008	Categories 1-4	Swiss e-waste programme	Finlay and Liechti 2008
Morocco	2008	Category 3 & 4	Hewlett Packard	Laissaoui and Rochat 2009
Chile	2007	Category 3	Swiss e-waste programme	Steubing 2007,, Steubing et al. 2010
Colombia	2008	Category 3 & 4	Swiss e-waste programme	Ott 2008
Brazil	2009	Categories 1-4	Swiss e-waste programme	Rocha 2009
Kenya	2008	Category 3 & 4	Hewlett Packard	Waema and Mureithi 2008

Category 1: Large household appliances, Category 2: small household appliances, Category 3: IT and telecommunications equipment,

Annex 2 :Questionnaire to EEE importers

Date:	Location:	Interviewer:
Interview introduction		
I am (name interviewer) coming from We are collecting data on e-waste generation and management in order to Can we ask you some questions about e-waste? / Thank you for participating in our survey		
General information about company		
<input type="checkbox"/> Import and/or <input type="checkbox"/> Production of electrical and electronic equipment (EEE)		
Name of company		
Address / City		
Number of employees		
Year of foundation		
Name and function of contact person		
Telephone		
E-mail		
Main activity		
To which economic se	<input type="checkbox"/> Collection <input type="checkbox"/> Dismantling/Recycling <input type="checkbox"/> Refurbishment <input type="checkbox"/> other:	
Is your institution ISO 14001 certified? (ISO 14001 is an international certification for an environmental management system)		<input type="checkbox"/> YES <input type="checkbox"/> NO
Introducing question		
Do you know what e-waste or waste of electrical and electronic equipment (EEE)/ waste of electrical and electronic equipment (WEEE) is? (describe to interviewed person what EEE)/WEEE is, if necessary....)		
1. Questions about awareness and behaviour		
	<i>Question</i>	<i>Answer</i> <i>Enhance the replies with comments, suggestions, details, etc.</i>
1.1	Are you aware about the environmental hazards caused by discarded EEE	<input type="checkbox"/> YES <input type="checkbox"/> NO
1.2	Are you aware that some EEE parts may be profitably recycled?	<input type="checkbox"/> YES <input type="checkbox"/> NO

1.3	Are you aware that some hazardous fractions in EEE need a special treatment in order to be safely disposed of?	<input type="checkbox"/> YES <input type="checkbox"/> NO	
-----	----------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------	--

2. Imported / produced electric and electronic equipment (EEE)

2.1 EEE-products

- a) Which EEE-products does your company import / produce?
- b) How many units per year of each product does your company sell?
- c) Which percentage of your imported products are second hand products? (please tick)
- d) What is the (estimated) national market share in % of your company for each product?
- e) According to your experience, what's the average life span of each product?
(from the purchase by the consumer to the disposal by the consumer)

a)	b)	c)	d)	e)
Product	units/year	% second hand	market share %	ø life span (years)
<i>If PCs or TVs are imported/ produced, ask for the LCD-CRT ratio of the monitors!</i>				

2.2 Distribution of products / customers

Product	Who are the (main) customers for each product?
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:
	<input type="checkbox"/> Wholesaler <input type="checkbox"/> Retail <input type="checkbox"/> Direct sale to private users (households) <input type="checkbox"/> Direct sale to public institutions <input type="checkbox"/> Direct sale to corporate users <input type="checkbox"/> others:

General questions

Question	Answer	Enhance the replies with comments, suggestions, details, etc.
----------	--------	---------------------------------------------------------------

3.1	Is the principle “Extended Producer Responsibility” (EPR) known in your company?	<input type="checkbox"/> YES <input type="checkbox"/> NO	if yes: could you describe it shortly?
-----	----------------------------------------------------------------------------------	-------------------------------------------------------------	----------------------------------------

3.2	Is your company working on a formal basis or is it an informal company? <input type="checkbox"/> formal <input type="checkbox"/> informal
-----	----------------------------------------------------------------------------------------------------------------------------------------------

3.3	Is your company member of any association or body of importers and/or producers of electrical and electronic equipment (EEE)?	<input type="checkbox"/> YES <input type="checkbox"/> NO	if yes: name of body/association?
-----	-------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------	-----------------------------------

3.4	Is your company member of any association or body which is in charge of a proper e-waste management (collection and recycling)?	<input type="checkbox"/> YES <input type="checkbox"/> NO	if yes: name of body/association?
3.5	Please describe your company's strategy to collect and recycle the e-waste generated by its customers?		
3.6	From your point of view, what are the main obstacles for a proper e-waste treatment?		
3.7	What should be done to facilitate e-waste management (to your company)?		
3.8	Would you be willing to pay for a service/organisation which collects and treats the e-waste generated by your customers? <input type="checkbox"/> YES <input type="checkbox"/> NO		
	If yes: at what conditions? (e.g. pickup service, guarantee of proper disposal, reliability, etc.)		
3.9	General remarks		

Annex 3. Questionnaire for WEEE recyclers

Date:	Location:	Interviewer:
Interview introduction		
I am (name interviewer) coming from We are collecting data on e-waste generation and management in order to Can we ask you some questions about e-waste? / Thank you for participating in our survey		
General information about company		
Name of company		
Address / City		
Number of employees		
Year of foundation		
Name and function of contact person		
Telephone		
E-mail		
Main activity		
Which e-waste activities does the company carry out?	<input type="checkbox"/> Collection <input type="checkbox"/> Dismantling/Recycling <input type="checkbox"/> Refurbishment <input type="checkbox"/> Other:	
Is your company ISO 14001 certified? (ISO 14001 is an international certification for an environmental management system)		<input type="checkbox"/> YES <input type="checkbox"/> NO
Introducing question		
(Introduction & introductory question, answers will not be evaluated. First question should ideally be answered with yes in order to set up a positive atmosphere for the interview to be held.)		
Do you know what e-waste or waste of electrical and electronic equipment is? (describe to interviewed person what e-waste is, if necessary....)		
1. Questions about awareness and behaviour		
	<i>Question</i>	<i>Answer</i> <i>Enhance the replies with comments, suggestions, details, etc.</i>
1.1	Are you aware about the environmental hazards caused by discarded electrical and electronic equipment?	<input type="checkbox"/> YES <input type="checkbox"/> NO
1.2	Are you aware that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?	<input type="checkbox"/> YES <input type="checkbox"/> NO if yes: which ones?
2. Collection of (waste) electrical and electronic equipment		

	Question	Answer	
2.1	<p>By which strategies and channel does your company collect e-waste?</p> <p><i>Which stakeholders are involved? Responsibilities? etc.</i></p>		
2.2	<p>In terms of amounts, which one is the most important strategy/channel?</p>		
2.3	<p>Do you cooperate with other companies/authorities for collection purposes?</p>	<div> <input type="checkbox"/> YES <input type="checkbox"/> NO </div>	<p>if yes: which ones? can you provide any details?</p>
2.4	<p>Which company transports the materials during collection?</p>		
2.5	<p>What are the main obstacles for a proper e-waste <u>collection</u>?</p>		

3. Recycling / treatment of waste electric and electronic equipment (WEEE)

3.1WEEE products that are treated

a) Product	b) actual throughput (indicate unit)	c) capacity (indicate unit)	d) pay / charge	e) price (indicate unit)
<i>Note: don't forget to write down the units of the indicated numbers!</i>				
General (all products)			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> fee	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> fee	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
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			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> ay <input type="checkbox"/> arge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	
			<input type="checkbox"/> pay <input type="checkbox"/> charge <input type="checkbox"/> free	

3.2 Material fractions arising from WEEE

a) Which material fractions arise from your company's recycling activities?

What does your company do with each material fraction? (treatment/destination)

Passing on the respective fraction to a further treatment, disposal, refining, etc.: is this associated with an income or with costs for your company, or does this happen for free? (please tick)

In case of income / costs: could you indicate an average price you get / pay

a)	b)	c)	d)
Material fraction	Treatment / destination (e.g. indicate company, market, type of treatment etc.)	income/costs	price (indicate unit)
Note: don't forget to write down the units of the indicated numbers!			
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	
		<input type="checkbox"/> income <input type="checkbox"/> costs <input type="checkbox"/> free	

General questions about recycling/treatment of e-waste

3.3	<p>Which processes does your company carry out?</p> <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> Sorting of products <input type="checkbox"/> Manual dismantling <input type="checkbox"/> Shredding <input type="checkbox"/> Separation of (shredded) fractions <input type="checkbox"/> Cable stripping/granulation </div> <div> <input type="checkbox"/> Burning (e.g. cables, cases) <input type="checkbox"/> Leaching (e.g. printed wiring boards) <input type="checkbox"/> other: </div> </div>	
3.4	How many workers are engaged in the recycling operation?	

3.5	What environmental measures does your company undertake to prevent the release of hazardous substances?	
3.6	Which measures undertakes the company to prevent health damages to the workers?	

4. Refurbishment of (waste) electric and electronic equipment			
4.1(W)EEE products that are refurbished			
b) Which electrical and electronic products are refurbished in your company? c) How many units are refurbished per month? (throughput) d) What is the average purchase price you pay for a product your refurbish? e) What is the average sales price you get for your refurbished product?			
a) Product	b) actual throughput (indicate unit)	c) purchase price (indicate unit)	d) sales price (indicate unit)
Note: don't forget to write down the units of the indicated numbers!			
General (all products)			
General questions about refurbishment			
	Question	Answer	

4.2	Where does the company get the appliances that are apt for refurbishment?		
4.3	By which channels does your company sell the refurbished products?		
4.4	What is done with parts or products which cannot be used for refurbishment?		
4.5	How many workers are engaged in the refurbishment operation?		
5. General questions			
	Question	Answer	Enhance the replies with comments, suggestions, details, etc.
5.1	Apart from e-waste, which other materials is your company working with?	e.g. scrap metals, paper, plastic, etc.	
5.2	Is your company working on a formal basis or is it an informal company? <input type="checkbox"/> formal <input type="checkbox"/> informal		
5.3	Is your company member of any association or body of recyclers?	<input type="checkbox"/> YES <input type="checkbox"/> NO	if yes: name of body/association?

5.4	Does your company cooperate with other companies or authorities in order to collect and recycle e-waste?	<input type="checkbox"/> YES <input type="checkbox"/> NO	if yes: name? can you provide details?
5.5	From your point of view, what are the main obstacles for a proper e-waste <u>treatment</u> ?		
5.6	What should be done to facilitate e-waste treatment (to your company)?		
5.7	Are you satisfied with the current financing of e-waste management? <input type="checkbox"/> YES <input type="checkbox"/> NO		
	If no: what should be improved? (e.g. fee, regulation, corporate responsibility (EPR), etc.)		
5.8	General remarks:		
Interview closure			
<ul style="list-style-type: none"> • Thank you for participating in this survey • The interviewer could also provide information about <u>when and where</u> the results of the survey will be available (if this is the case) 			

Annex 4Stakeholders meet

Name	Company	Location	Contacts
Mr.SethMunyambu	Waste Electrical and electronic equipment Kenya	National Youth service Ruaraka	seth@weeecenter.com +254733986558
Mr. Seth Munyambu	Computer for schools Kenya	National Youth service Ruaraka	seth@weeecenter.com +254733986558
Mr. Paul Wachira	Kariokor &Ngara dump site	Kariokor and Ngara	
Mr. Chege	Limuru dump site	Limuru	
Mr. Tony Maina	Ace.comp	Yusuf Ali Masion ground floorMombasa	computers@acemerchants.biz
Mr. Seth Munyambu	Computer For schools Kenya	Government Training Institute, Mombasa	
Euro used Electronic General Store	Euro used Electronic General Store	Jomo Kenyatta Avemue	+254725833835
Cindy	harness-tech systems	yunis floor; ground	+254733791002
	Saba Saba stalls and warehouses	Mombasa	