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The International POPs Elimination Project (IPEP)

*Fostering Active and Effective Civil Society Participation in
Preparations for Implementation of the Stockholm Convention*

Assessment of the Lagos Lagoon for POPs Sources, Types and Impacts



Friends Of The Environment (FOTE)

**Nigeria - Anglophone Africa
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ABOUT THE INTERNATIONAL POPs ELIMINATION PROJECT

On May 1, 2004, the International POPs Elimination Network (IPEN <http://www.ipen.org>) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see <http://www.ipen.org>

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The views expressed in this report are those of the authors and not necessarily the views of the institutions providing management and/or financial support.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASP	-	African Stockpiles Programme
CBOs	-	Community Based Organizations
CIEN	-	Chemical Information Exchange and Network
DAK	-	Ketones
ESTIS	-	Environmentally Sound Technology Information System
FAO	-	Food and Agriculture Organization
HCB	-	Hexachlorobenzene
IPEP	-	International POPs Elimination Project
KCl	-	Potassium Chloride
LDPE	-	Low Density Poly-ethylene
MAN	-	Manufacturers Association of Nigeria
NEPA	-	National Electric Power Authority
NGOs	-	Non-Governmental Organizations
NIP	-	National Implementation Plan
NH ₄ Cl	-	Ammonium Chloride
PCBs	-	Polychlorinated Biphenyls
PHCN	-	Power Holding Company of Nigeria
POPs	-	Persistent Organic Pollutants
PVA	-	Polyvinyl amine and amides
PVC	-	Polyvinylchloride
SBC	-	Secretariat of Basel Convention
TEQ	-	Toxic Equivalent
UNEP	-	United Nation Environment Programme
UNIDO	-	United Nations Industrial Development Organization
ZnCl	-	Zinc Chloride

1.0 EXECUTIVE SUMMARY

The project main objective was to conduct an assessment of the Lagos Lagoon as a suspected POPs hotspot site receiving enormous wastewater from an estimated 2000 significant industrial users, small industrial users, commercial establishments and domestic sources. The project involved extensive literature reviews, consultation with key stakeholders, surveys, identification of suspected POPs sources and types, associated risks and existing efforts for containment and remediation measures.

The industries were divided into sectors and questionnaires were designed and distributed according to the sectors. Out of the total 40 questionnaires distributed, the survey revealed that 47.5% of the respondents were afraid to give any information to forestall possible government action. It was found that 47.6% of the surveyed facilities had the potential to release POPs due to their activities. The greatest sources being the generation of dioxins and furans through uncontrolled incineration at dumpsites, including the use of polyvinylchloride (PVC) resins as raw materials for their production. The awareness level in the industries was found to be higher than the general public.

In conclusion, the survey revealed that while some materials used may contain POPs, there is unintentional production of POPs chemicals by industries within the studied area. However, laboratory tests will have to be carried out to determine the level and types of POPs discharged into the lagoon.

It is recommended that, in view of the enormous environmental, public health and economic burden of POPs especially in developing countries, it is imperative that NGOs, CBOs, other stakeholders and governments develop the necessary legislation for the regulation and control of POPs reflecting the requirements of the Stockholm Convention, while making provision for effective enforcement.

2.0 BACKGROUND

2.1 Nigeria

Nigeria, the most populous nation in Africa, is situated in the western part of the continent between latitudes 4.16 and 13.52N and longitude 2.40 and 14.32 east. It is bordered by Niger Republic in the north and the Republic of Cameroon in the east, Republic of Benin in the west and the Atlantic Ocean in the south in an 853km long coastline (Fig 1). Lagos State, one of the thirty six (36) states of Nigeria lies in the

south-western corner of Nigeria and falls within the 853km stretch interconnection as far as to the neighbouring Ogun State.



Fig 1: Map of Nigeria

2.2 Lagos Lagoon

The Lagos Lagoon is a water body in the heart of the metropolis, and cuts across the southern part of the metropolis, linking the Atlantic Ocean (in the west and south) and Lekki Lagoon (in the east). It is about 6354.788sq km in area and 285km in perimeter. The lagoon provides places of abode and recreation, means of livelihood and transport, a dumpsite for residential and industrial discharge and a natural shock absorber to balance forces within the natural ecological system.

About 80-85% of the industries in Nigeria are located in Lagos State and they all discharge their effluents into the Lagos lagoon. The effluents discharged are mainly untreated, while very few industries have any treatment plants. The Lagos lagoon consists of three (3) main segments namely the Lagos Harbour Segment (Fig. 2), the Metropolitan and the Epe Division Segment.



Fig. 2: Main segments of the Lagos Harbour

Apart from marine transportation and fishing, complex mixtures of domestic and industrial effluents enter the Lagos Lagoon daily. In addition to wastewater from industries, there are domestic sewage discharges; garbage and wood shavings from sawmill depots along the shores of the lagoon. The proliferation of urban and industrial establishments along the shores of the lagoon has resulted in a complex mix of both domestic and industrial wastes.

3.0 METHODOLOGY

3.1 Scope of Assessment

- i. literature review
- ii. existence of POPs chemicals and associated risks
- iii. existing management efforts and remediation measures in Nigeria
- iv. survey with key stakeholders, sources and types of POPs or by-products.

The survey aims to:

- i. identify and document all industries emissions and those discharging in Lagos lagoon;
- ii. identify those industrial activities that are related to production or by-products of POPs chemicals;
- iii. determine the type and extent of the impact of the activities/ POPs on the environment.

The possible POPs sources were identified as:

- Dump sites
- Canal dumpsite
- NEPA/PHCN installations
- Chemical stores for chemicals like Gamalin 20 etc
- Transformer oil containing PCB
- Lagos Lagoon
- Used drums (imported as containers for PCB oil for transformers used by the public)
- Industrial areas
- Chemical Companies

- Hydraulic train
 - Lister Generator Operator
-
- Electric transformers
 - Insecticides/aerosol
 - Textile industries
 - Manufacturing company (using PCBs, PVC and undergoing high heat in manufacturing)
 - Ink solvents
 - Residential areas
 - Homes i.e. burning of refuse
 - Water Bodies
 - Atmosphere

Some of the associated health hazards are:

- Cancer
- Diseases and deaths
- Disabilities
- Discomfort
- Cough
- Bacterial infection
- Damage to liver
- Birth deformation
- Lung infection
- Impotency
- Brain deformity
- Diarrhoea

- Skin infection
- Nervous disorder
- Kidney problems
- Heart diseases
- Catarrh
- Irritation to respiratory tract
- Headache and dizziness
- Shortened life span
- Loss of memory
- Liver cirrhosis

Some of the associated impacts on the environment are:

- Direct toxicity to non-target organisms
- Destruction or contamination of food sources
- Habitat destruction
- Bio-accumulation to critical levels in living organisms
- Reduced reproductive success
- Immuno-suppression in organisms

- Population decline and reproductive effects
- Eggshell thinning
- Metabolic changes
- Deformities and birth defects
- Tumors and cancers
- Behavioral changes
- Abnormally functioning thyroids
- Hormonal system dysfunction
- Immune suppression
- Feminization of males and masculinization of females

The project was undertaken in a three (3) phase format in line with the scope of assessment.

The three phases are:

- i. pre-assessment
- ii. assessment
- iii. post-assessment

3.2 Pre-assessment

The pre-assessment consisted of the literature review and pre-assessment meetings where the questionnaires used for the survey were drawn and the resource persons and enumerators chosen. The guidelines for the questionnaires and questionnaire administration were developed and produced. Areas to be covered were identified and time frame spelt out for each enumerator.

3.3 Assessment

The assessment was carried out by trained personnel in the field of environment.

The industries were classified into different categories based on Manufacturers Association of Nigeria (MAN) classification viz: -

- (i) Food and beverages
- (ii) Chemicals, plastics, paints and pharmaceuticals
- (iii) Textiles
- (iv) Basic metals / pulp and paper subsection.

The assessment focused on industries that are thought to be heavy users of chlorine based chemicals and agrochemicals including power plant.

The assessors (study team) visited the industries and collected the required information based on the questionnaires and additional consultation as necessary.

3.4 Post-assessment

The post assessment activity involved first the data collation and analysis. Table 1 involved the assessment and quantification of POPs.

Table 1: Possible POPs sources identified from the study

S/N	Name of Facility	Products/ activity	Chemical or material that potentially contributes to POPs formation
1.	Battery Manufacturing Company (BAMCO) (Nig) Ltd., Ikeja	Flash dry cell battery	Mercuric chloride, NH ₄ Cl, Paraffin wax, PVC, PVA, ZnCl ₂ , sizing agent
2.	West Africa Household Utilities Mfg. Co. (WAHUM) (Nig) Ltd., Ikeja	Household enamelware products	Potassium chlorate, PVA, NH ₄ Cl, KCl
3.	Woollen & Synthetic Textiles Mfg. Ltd., Ikeja	Suiting, shirting materials, bed sheets, towels	Disperse dyes, reactive dyes, vat dyes, pigment dyes
4.	Unilever Nig. Plc., Oregon	Vaseline cream, Lux soap, Pears soaps & cream, toothpastes	Large chemicals users, but no POPs chemicals information provided
5.	Cotsyn (Nig) Ltd., Ilupeju	Shirting materials, foam cover (printed) printed & woven furnishing	Reactive dyes, disperse dyes, pigment
6.	Eagle Paints (Nig) Ltd., Agidingbi, Ikeja	Supercote emulsion gloss enamel eagletex	PVA, pigments, DAK
7.	Mouka Limited, Ikeja	Polyurethane foam products	Methylene chloride, toluene di-isocyanate
8.	Coates Brothers (W.A.) Ltd., Agidingbi, Ikeja	Paste/screen liquid inks metal coatings	Pigments, resin
9.	Nigeria Ball-Point Pen Industries Plc.	Big ball point pens, big razor shavers	LDPE hips, ink past polystyrene, polypropylene, PVC.
10.	Multichem Industries Ltd., Ikeja	Textile Auxiliaries, dyestuffs, pigments/inks	Dyestuffs, pigments, solvents
11.	Lagos State Agric Inputs Supply Authority, Ojo		Paraquat, dichloride, lambdacyhalothien, aluminium phosphate atrazine, diazol, diuron
12.	AES Nigeria Barge Ltd.	Electricity generation	Transformer oil
13.	Egbin Electric Power Business Unit, PHCN	Electricity generation	Transformer oil
14.	Super Engineering Co. Ltd	PVC Slippers	PVC, PVC scrap
15.	Lucky Fibres (Nig) Ltd.	Polypropylene yarn, tufted carpets	Fire retardant
16.	West African Rubber Products Nig. Ltd	Bathroom slippers	PVC
17.	Olusosun Dumpsite, Lagos State	Dumpsite burning	Dioxin and furan
18.	Solous dumpsite, Lagos State	Dumpsite burning	Dioxin and furan
19.	Abule Egba dumpsite, Lagos State	Dumpsite burning	Dioxin and furan

4.0 CHARACTERISTICS OF POPs AND THE STOCKHOLM CONVENTION

4.1 The Stockholm Convention

The Stockholm Conventions on Persistent Organic Pollutants aims to protect human health and the environment from persistent organic pollutants (POPs). The Convention which is global in scope and multimedia in coverage identifies twelve substances for initial global action. These substances are categorised as pesticides; industrial chemicals; chemical by-products that are unintentionally formed and released to the environment in combustion and chemical processes.

The pesticides POPs include aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex and toxaphene. Industrial chemicals include polychlorinated biphenyls (PCBs) and by-products of industrial processes and combustion are dioxins, furans, HCB, and polychlorinated biphenyls (PCBs).

4.2 POPs Characteristics

Persistence – the ability to resist degradation in various media (air, water and sediments) for months and even decades.

Bio-accumulation – the ability to accumulate in living tissue at levels higher than those in the surrounding environment.

Potential for long range transport – the potential to travel long distance from the source of release through various media (air, water and migratory species).

According to existing scientific evidence, health effects such as cancers and tumours at multiple sites, reproductive defects and sex-linked disorders, shortened period of lactation in nursing mothers and diseases such as endometriosis (a painful, chronic gynaecological disorders in which uterine tissue grows outside the uterus), increased incidence of diabetes etc; have been associated with human exposure to specific POPs or classes of POPs.

4.3 Stockholm Convention in Nigeria

As part of national efforts to protect human health and the environment from the effects of the exposure to POPs, Nigeria signed the Stockholm Convention in May 2001 and ratified it in May 2004. The country in collaboration with the Food and Agriculture Organisation of the United Nations (FAO), the Secretariat of the Basel Convention (SBC), the UNIDO organised an awareness seminar on hazardous substances in 2004, and in conjunction with UNEP is also conducting an inventory of dioxins and furans in Nigeria. Prior to the actual inventory exercise, the country organised sensitization

workshops in the northern zone (Kaduna), southern-eastern zone (Port-Harcourt) and south-western zone (Lagos).

The country also organised a training workshop on Inventory of Obsolete Pesticides in Nigeria in 1999. Also a Standing Committee on National Chemicals Management Control Actions has been put in place. The National Policy on Environment which was issued in 1989 and revised in 1999 however contains sections on the control of the importation of hazardous substances including POPs.

5.0 POPs AND CHEMICALS USE IN NIGERIA

The Nigerian experience from available research shows that major POPs-contaminated air, soil and water arise basically from the use of pesticides. Over 95% of all pesticides are imported as finished pre-packed products. Pesticides use in Nigeria include certain chemicals that for environmental and health reasons have been partially or completely banned in developed countries. However, such chemicals are smuggled into Nigeria for pest control, and these are problematic because they are cheap and not subject to any regulation.

The most commonly used pesticides are Lindane (Gamma BHC) on Kolanuts (*Cola nitida*) for protection against Kola-nut weevils (*Balanogastrius Kola*). It is also widely used by fishermen to kill fish for commercial purposes in Nigeria. Lindane which has been nominated for inclusion under the Stockholm Convention, is presently not manufactured in Nigeria, but is illegally imported and used. Fenthion (an organophosphate pesticide) is an effective avicide and is used mostly in the northern part of Nigeria against bird pests. DDT and Gammalin 20 (1,2,3,4,5,6,-hexachlorocyclohexane) rodenticides have been outlawed but are still illegally used in some parts of Nigeria.

Until recently, the adverse effects of pesticides and their residues on non-target organisms have not been seriously considered in Nigeria. For example, information on lethal limits of pesticides on Nigeria fish or food crops scarcely exists. (Ezemonye and Ilechie are currently working on Atrazine toxicity to Amphibian tadpoles; Ezemonye and Ohofosa are working on Gamalin 20 bio-accumulation in fish from Niger Delta waters).

PCBs have also been identified in water sediments and fish in Niger Delta water namely Ethiope, Benin and Warri Rivers (Ezemonye 2005). Earlier studies by Osibanjo and Bamgbose (1990) revealed the presence of PCBs in the Nigerian Environment. Risks associated with drinking PCBs contaminated surface and underground water supplies were highlighted.

Some experts have reported traces of PCBs at the massive Oshodi – Oworonsoki expressway dumpsite and Adeniji Adele areas of Lagos.

These activities and remains of POPs and other toxic chemicals could find its way to the Lagos Lagoon and other related bodies and continue to affect the Nigerian population.

Akingbade in his book 'Nigeria on the Trail of Environment' has reported uncommon ailments associated with PCB contamination to include:

- lack of brain coverage in children
- microcephally (case of small brains)
- macrocephaly (cases of extra large brain)
- congenital heart disease
- blocked anus in children
- urogenital disorder.

5.1 Assessment and Quantification of study results

The results of analysis of the data in Table 1 from the field survey showed that only 47.5% of the questionnaires were retrievable, because respondents were afraid to give any information to forestall possible government action. This may indicate that a large number of companies currently generate POPs and other pollutants and dump them into the lagoon. The survey showed that as many as 47.6% of the questionnaires retrieved have a potential link with POPs due to their activities, the greatest being the generation of dioxins and furans from uncontrolled incineration and burning at dumpsites and the use of polyvinyl chloride (PVC) resins by the industries for their production. It was also found during the study that the level of awareness in the industries is higher than among the general public.

5.2 Existing Efforts for POPs Management by Federal Government

The Federal government of Nigeria commenced the National Implementation Plan (NIP) in 2001 and so far the activities carried out include:

- data generation which involved taking inventory of POPs including dioxins and furans in the six geopolitical zones of Nigeria example:

Estimation of dioxins/furans generated per annum at Olusosun and Soluos dumpsites in Lagos (southwest Nigeria):-

Olusosun Dumpsite	= 24,686mT/wk
Soluos Dumpsite	= <u>1,570mT/wk</u>
	<u>26,255mT/wk</u>

$\therefore 26,255 \times 52 = 1,365,260\text{mT/annum}$
 $1,365,260 \times 300$ (Default emission factor range $\mu\text{gTEQ/t}$)
 $= 409,578,000 \div 106$
 $= 40,957\text{gTEQ/annum}$ Potential Emission of Dioxins/Furans
from the two dumpsites.

- established a National Steering Committee comprising all stakeholders including relevant ministries, agencies, academics, NGOs, CBOs, farmers, etc.
- commenced the Africa Stockpiles Programme (ASP) project
- submitted a project brief for developing appropriate strategies for identifying and treating selected sites contaminated by chemicals listed in Annex A, B or C of the Stockholm Convention.
- hosted a training programme conducted by UNEP on Chemicals Information Exchange and Network (CIEN) and on Environmentally Sound Technology Information System (ESTIS), for web page design, database development and networking within the framework of CIEN in February, 2006.

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In general, the survey revealed an unintentional production of POPs chemicals such as HCB and PCBs and proposed candidates by industries. However, the list of their raw materials/products submitted revealed the use of chlorine based raw materials which might have great potential for the release of POPs by-products; and likely dioxins and furans resulting from the processes and uncontrolled burning.

A major constraint experienced during the period of the survey was the lack of public and industry awareness on POPs. A lot of work needs to be carried out in awareness creation in both the industries visited and the public at large especially in the area of smuggled POPs and other toxic materials.

6.2 Recommendation

In view of the enormous environmental, public health and economic burdens caused by stockpiles of POPs especially in the developing

countries, it is imperative that NGOs, CBOs and other stakeholder be involved by their governments in the development and review of the necessary legislation for the regulation and registration of chemicals including POPs as required by the Stockholm Convention and other international agreements.

With the high rate of smuggling of POPs and other toxic materials, it is imperative that effective enforcement system be put in place.

A pollutant release and transfer registry (PRTR) should be established to reveal current levels of chemical releases by industries surrounding the lagoon.

Appropriate educational, advisory, extension and health care services should also be established.

NGOs, CBOs and the Federal Government should engage in public sensitization and awareness-raising in control actions to discourage illegal import and use of POPs chemicals by an unsuspecting public.

There is a need for adequate funding for building capacity in the containment and remediation of POPs-contaminated sites at national and international levels.

Poison centres should also be established and ensure their functioning by the government for the control of POPs.

The burning in dump sites for disposed solid wastes should be eradicated and replaced with other safer methods such as the use of composting and other sound methods, while liquid wastes should be properly treated before discharge into the lagoon.

Development of a viable alternative to DDT for malaria control is necessary towards a phase out plan that will attempt to eliminate its use and production.

Chlorine free plastic including polyolefins such as polypropylene or polyethylene may be substituted for PVC in many products.

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APPENDICES

APPENDIX I: PLATES



Plate 1: Open dump site at Ojota

The dumpsite undergoing burning and emission of thick fumes with likely generation of dioxins and furans



Plate 2: PHCN Workshop with obsolete transformers containing PCBs

The installation at Ijora causeway with likely transformer oil leakage directly into the lagoon



Plate 3: Industries discharging effluent into the lagoon

Some of the industries using chlorine based chemicals which dump their effluent untreated directly into the lagoon behind the factories



Plate 4: Part of the Lagos lagoon