



## REPUBLIC OF SIERRA LEONE

### National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (POPs)



Ministry of Lands, Country Planning and the Environment

Freetown, Sierra Leone

May 2008



## FOREWORD

There is no doubt that issues of the environment are increasingly receiving greater accent by the Global Community. The reason for this sudden awakening has to do with the “success” we have made of development without going through the necessary stock-taking that is the basis for sustainability. Our zealous/insatiable and sometimes greedy pursuit of the comforts and luxury in the name of development has most times left us blind to the delicate nature of our environment and therefore to the need to protect its integrity. Perhaps it is apt to remind us all that while we savour the comforts of development we must bear in mind that these comforts have been won at some price. This price is clearly manifested by the emerging and more troublesome challenges that presently attend life on earth.

Arguably the development front that has achieved the most spectacular results is the production, use and management of chemicals. I am sure everybody on the globe must have benefited one way or the other from the use of chemicals – as medicines/drugs in the cure of diseases, relief of pain, control of moods, etc.; as food supplements and additives to help optimise the benefits of food intake, in especially imparting the feeling of well-being; in athletics to maximise/boost energy supply; as pest/vector control agents in the control of disease transmission and the eradication of epidemics; as agrochemicals in the maximisation of crop and animal yields as well as the control of post-harvest loss; in the treatment of timber and other wood products in the construction industry to prevent attack by termites and other bugs; in the purification of drinking water to control water-borne diseases; etc. (the list goes on). I am equally sure that almost everybody must have witnessed the down side effects of the use of chemicals – as manifested by the negative impact on human and animal health arising from the high incidence of relatively new health conditions such as tumours and cancers, deformities in newly-born babies, nervous and psychiatric diseases, etc. caused by the conscious and unconscious ingestion of unpalatable chemicals or of palatable chemicals above unacceptable limits.

It is as a result of these disturbing downsides to the use of chemicals that has galvanised the Global Community - led by the United Nations Environment Programme (UNEP) and its partners – to introduce globally binding measures aimed at managing the production, release and use of chemicals.

At present twelve (12) chemicals are officially recognised as POPs; these, often referred to as the “dirty dozen”, are:

**Table 1: List of POPs**

1. Aldrin	2. Chlordane	3. Dieldrin
4. Endrin	5. Heptachlor	6. Hexachlorobenzene (HCB)
7. Mirex	8. Toxaphene	9. DDT
10. Polychlorinated biphenyls (PCBs)	11. Dioxins (PCDDs)	12. Furans (PCDFs)



Other chemicals including lindane and chlordecone are currently being assessed with the view to listing them as POPs but these will only be officially adopted by the Conference of the Parties (COP), the highest decision-making body of the Stockholm Convention on POPs.

As a Signatory and Party to the Stockholm Convention on Persistent Organic Pollutants, Sierra Leone is required by Article 3 to prohibit and/or take legal and administrative measures necessary to eliminate a) the production and use of chemicals listed in Annex A taking cognizance of the relevant provisos; b) the import or export of chemicals listed in Annex A; c) restrict the production and use of chemicals listed in Annex B.

Sierra Leone is also required by Article 5 to take measures to reduce the total releases derived from anthropogenic sources of the chemicals listed in Annex C; this refers to chemicals present as impurities in conventional chemicals and released into the environment through unintended use, i.e. by accident.

Article 12 of the Stockholm Convention on POPs provides technical assistance to Developing Country Parties and Parties with Economies in Transition with a view to develop and strengthen their capacities to implement their obligations under the Convention. One key obligation is to develop a National Implementation Plan (NIP) which must serve as the blue print for the execution of the provisions of the Convention.

In view of the above, the Government of Sierra Leone is determined to implement the NIP and has already drafted legislation on POPs management, agricultural and industrial chemicals for effective and sustainable environmental management. I therefore endorse this National Implementation Plan (NIP) for the management of Persistent Organic Pollutants (POPs) and other toxic substance and chemicals on behalf of the Government of Sierra Leone in order to protect our people and the environment from their negative effects. The Government of Sierra Leone wishes to seek partnerships with its investment partners to translate the NIP into action and thus to reverse human and environmental degradation from POPs.



Benjamin O. Davies

Hon. Minister

Ministry of Lands, Country Planning and the Environment



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## GLOSSARY

AAS	Atomic Absorption Spectrophotometer
ADP	African Development Bank
APC	Air Pollution Control
APCS	Air Pollution Control System
ASP	African Stockpiles Programme
BAT	Best Available Techniques
BEP	Best Environmental Practices
BKPS	Bo-Kenema Power Service
BOD	Biological Oxygen Demand
BSAP	Biological Strategy Action Plan
CBD	Convention on Biological Diversity
CBO	Community Based Organisation
CCD	Convention on Combating Desertification
COP	Conference of Parties
CSSL	Conservation Society of Sierra Leone
DDT	Dichlorodiphenyltrichloroethane
ECOWAS	Economic Community of West African States
EFF	Extended Fund Facility
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPA	Environmental Protection Agency (United States)
EPD	Environmental Protection Department
EUR or €	Euro, Currency of the European Union
FAO	Food and Agriculture Organization (of the United Nations)
FTIR	Fourier Transform Infra Red
FWMS	Freetown Waste Management System
GEF	Global Environment Facility
GLP	Good Laboratory Practice
GOSL	Government of Sierra Leone
GTZ	Gesellschaft für Technische Zusammenarbeit (German Development Cooperation)
HCB	Hexachlorobenzene
HFO	Heavy Fuel Oil
HQ	Headquarters
IADP	Integrated Agricultural Development Project
IAR	Institute of Agricultural Research
IC	International Consultant
ICP	Inductively Coupled Plasma
ICRC	International Committee of the Red Cross
ICT	Information and Communication Technology
ILO	International Labour Organization
IMF	International Monetary Fund
IPCS	International Programme on Chemical Safety
IPEN	International POPs Elimination Network





IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
ISO	International Organization for Standardisation
IVM	Integrated Vector Management
MAFS	Ministry for Agriculture and Food Security
MDG	Millennium Development Goals
M&E	Monitoring and Evaluation
MEP	Ministry of Energy and Power
MFMR	Ministry of Fisheries and Marine Resources
MLCPE	Ministry of Lands, Country Planning and the Environment
MLIR	Ministry of Labour and Industrial Relations
MMA	Mines and Minerals Act
MMR	Ministry of Mineral Resources
MoHS	Ministry of Health and Sanitation
MSF	Médecins sans Frontières (Doctors without Borders)
NaCEF	National Commission on the Environment and Forestry
NAPA	National Environmental Action Plan
NC	National Consultant
NEEP	National Economic Emergence Programme
NEP	National Environmental Policy
NEPAD	New Partnership for African Development
NGO	Non-governmental Organisation
NIP	National Implementation Plan
NPA	National Power Authority
NPC	National Project Coordinator
NRA	National Revenue Authority
ODS	Ozone Depleting Substance
OSH	Occupational Safety and Health
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PIC	Prior Informed Consent
POP	Persistent Organic Pollutant
QMS	Quality Management System
RBMP	Roll Back Malaria Programme
RRS	Rice Research Station
SAICM	Strategic Action for International Chemicals Management
SALWACO	Sierra Leone Water Company
SC	Steering Committee
SHE	Security Health Environment
SLEDIC	Sierra Leone Export Development & Investment Cooperation
SLL	Sierra Leone Leone (USD 1 = SSL 2,999.62 as of 14 May 2008)
SLPA	Sierra Leone Ports Authority
SLPMB	Sierra Leone Produce Marketing Board
SLSB	Sierra Leone Standards Bureau



TEF	Toxic Equivalency Factor
TEQ	Toxic Equivalent Quantity
TIK	Technical Institute, Kenema
TOR	Terms of Reference
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCTAD	United Nation Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
UPM	UNIDO Project Manager
UPOP	Unintentionally Produced Persistent Organic Pollutant
UR	UNIDO Representative
USD or \$	United States Dollar
WHO	World Health Organisation
WIS	Waste Information System
WTO	World Trade Organisation



## ACKNOWLEDGEMENTS

I am delighted to thank the following institutions for making their professional staff available to participate in the preparation of this National Implementation Plan (NIP) for the safe management of Persistent Organic Pollutants (POPs) in the country: Njala University, Fourah Bay College, Ministry of Agriculture, Forestry and Food Security, Ministry of Mineral Resources, Ministry of Health and Sanitation, Ministry of Trade and Industry, Sierra Leone Standards Bureau, Ministry of Energy and Power, Ministry of Development and Economic Planning, the civil society, and the Environment Protection Department.

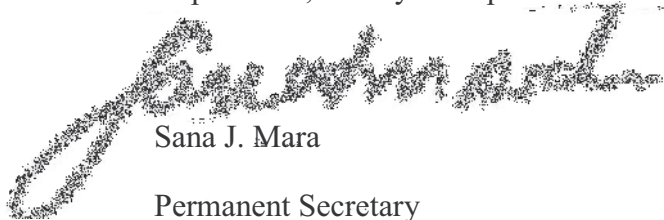
I am thankful to the stakeholders for their useful comments during the various consultative workshops conducted on the NIP development.

I am also highly indebted to the United Nations Institute for Training and Research (UNITAR) for supporting training on Action Plan development.

I wish also to thank the Global Environment Facility for funding the project and the United Nations Industrial Development Organization expert team, particularly Dr. Grace Ohayo-Mitoko and Dr. Richard Temsch, for their technical and supervisory role played during the process on the NIP development document.

Finally, I wish to thank all members of the National Steering Committee and the Task Team groups for the production of POPs inventory reports and their contribution throughout the implementation of the project.

At last but by no means the least, I wish also to recognise the excellent contribution made by the Project Coordinator, Mr. Samuel Adu Lappia for the effective and efficient day-to-day management and production of this report under the supervision of the Director of Environment Protection Department, Mr. Cyril Stephen James Jusu.



Sana J. Mara

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## EXECUTIVE SUMMARY

Persistent Organic Pollutants (POPs) are highly toxic chemicals of mostly anthropogenic origin that resist photolytic, chemical and biological degradation, causing an array of adverse effects, notably deaths, diseases and birth defects among humans and animals. They concentrate in fatty tissues of living organisms through processes of bioaccumulation and bio-magnification. Concentrations are magnified up the food chain. For example, fish, predatory birds, mammals and humans, who are higher in the food chain, absorb the greatest concentrations of POPs. At present twelve chemicals have been proved to exhibit POPs characteristics and these chemicals are divided into three categories. The first category is composed of intentionally produced pesticides (i.e. aldrin, dieldrin, DDT, endrin, chlordane, hexachlorobenzene, mirex, toxaphene and heptachlor). The second category comprises industrial chemicals, which are polychlorinated biphenyls (PCBs) and hexachlorobenzene, while the third is the unintentionally produced emissions of certain industrial and combustion processes, which include polychlorinated para dibenzodioxins and polychlorinated dibenzofurans.

### **Purpose of the National Implantation Plan (NIP)**

The National Implementation Plan (NIP) for Sierra Leone is prepared to elaborate the current situation on POPs and commitments and actions that it intends to undertake in the management and control of POPs for the period of 17 years beginning 2008. Moreover, it should help Sierra Leone to meet its obligations under the Stockholm Convention on Persistent Organic Pollutants. Article 7 of the Convention requires Parties to the Convention to develop a national implementation plan to meet the requirements of the Convention and communicate such plan to the Conference of Parties (COP) within two years of the coming into force of the Convention for the Party. Sierra Leone will therefore integrate the NIP into its national sustainable development plans where necessary.

The main objective of the NIP is to prepare comprehensive and realistic action plans for effective management of POPs chemicals and to reduce and or eliminate the use and release of POPs.

The development of the NIP is intended to yield the following objectives:

- (a) To achieve the commitment of the Government to the objectives of the Stockholm Convention for effective management of POPs chemicals;
- (b) To provide the basis for monitoring the action plans and strategies Sierra Leone has committed to undertake;
- (c) To review and update as appropriate its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of Parties;
- (d) To utilise and, where necessary, establish the means to integrate the National Implementation Plan for Persistent Organic Pollutants appropriately into the sustainable development strategies;
- (e) To cooperate directly or through global, regional and sub-regional organisations, and consult the national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of the NIP;
- (f) To facilitate public awareness, information, education and participation in POPs management issues, and overall improvement in environmental and public health protection.



## **NIP Development Process**

The process of developing a NIP is divided into five phases:

1. Establishment of a coordinating mechanism and process organisation;
2. Establishment of POPs inventories and assessment of national infrastructure and capacity;
3. Priority assessment and objective setting;
4. Formulation of the NIP;
5. Endorsement and submission of the NIP.

### **Phase One - Establishment of a coordinating mechanism and process organisation**

Phase One started with the appointment of the National Project Coordinator (NPC) in August 2006 and setting up the Project Coordinating Unit (PCU) within the Environment Protection Department in the National Commission on Environment and Forestry (NaCEF).

The National Steering Committee of 16 members from relevant ministries, agencies, academia and civil society was appointed as the policy making organ of the implementation framework.

The National Steering Committee appointed the National Technical Experts (NTE) comprising 10 experts from relevant sector ministries, government agencies, non-governmental organisations (NGOs) and academic and research institutions.

#### ***Identification of stakeholders***

In the month of September 2006, the Project Coordinating Unit identified the following institutions as the major stakeholders in the management of chemicals in the country: Ministry of Agriculture and Food Security, Ministry of Health and Sanitation, Ministry of Trade and Industry, Ministry of Transport and Communication, Ministry of Mineral Resources, Ministry of Foreign and International Cooperation, Sierra Leone Ports Authority, Sierra Leone Army, Ministry of Energy and Power, Local NGOs and CBOs.

### **Phase Two - Establishment of POPs inventories and assessment of national infrastructure and capacity**

Phase Two was concerned with the identification and quantification of POPs releases, assessment of the legal and institutional framework for POPs management, practices of managing POPs, experience and monitoring capacity on POPs, identification of POPs contaminated sites and assessment of public information, awareness and education. The reports by the various task team groups were reviewed and validated in a one day national consultative workshop held on 29 November 2007.

### **Phase Three -Priority assessment and objective setting**

This phase was concerned with the identification of measures and the formulation of preliminary objectives and strategies to address the gaps and deficiencies identified from the POPs inventory. The priority assessment measures were based on the criteria described in Articles 6, 10 and 11 of the Stockholm Convention: health impact, environmental impact, sustainability, monitoring of releases, management of contaminated sites, disposal facilities, knowledge base and institutional cooperation. Prioritisation objective setting and NIP development training workshops were held from 30 October to 2 November 2007. The country Priority Assessment Report was validated on 2 November 2007.



## **Phase Four - Formulation of the NIP**

This phase concerned the drafting of the NIP in accordance with the UNEP Guidelines on NIP Development (revised December 2004). The draft NIP was reviewed by the UNIDO International Consultant in May 2008. The NIP was endorsed by the stakeholders. The development of the NIP involved the PCU and the National Technical Experts drawn from government ministries and agencies, academic and research institutions, NGOs and CBOs.

The training of experts in both compiling POPs inventories and developing action plans was carried out by international experts from UNIDO and UNITAR respectively.

## **Phase Five – NIP endorsement and submission**

### **Assessment of the POPs issue in Sierra Leone**

#### ***Institutional, policy and regulatory framework***

It is clear from the assessment that the capacity of Sierra Leone to successfully execute the National Implementation Plan (NIP) for the elimination of POPs is presently very weak. The key institutional structures (especially the Environment Protection Department in the Ministry of Lands, Country Planning and the Environment) is still evolving and with the advent of new political dispensation dramatic developments may be in the offing; the state of requisite physical infrastructure (analytical chemistry laboratories and equipment) is very fragile especially with respect to the absence of equipment; the human capacity is grossly inadequate and also very weak especially in terms of numbers of adequately trained analytical chemists, laboratory technicians and equipment maintenance technicians as well as of legal drafters. The other area of capacity constraints is the lack of local resources to fund the NIP. It must be underscored that this capacity weakness is largely the result of the effects of the recently concluded civil war which dramatically accelerated the migration of trained personnel out of the country and also destroyed much of the country's infrastructure; it also severely compromised the Government's ability to mobilise resources to address environmental issues in the face of other more life threatening demands.

#### ***POPs pesticides***

A wide range of pesticides has been found to be in use in the country. However, most of the POPs pesticides in question, such as DDT and dieldrin, were in use but are now obsolete and not used any more in the country. Nevertheless, some quantities of HCB were identified. Other POPs pesticides were not discovered, perhaps because of the difficulty in accessing information and lack of trained personnel on POPs pesticides.

Sierra Leone is an agrarian country with many women and children exposed to the dangers of POPs. Exposure to POPs pesticides is mainly due to improper disposal of obsolete pesticides and containers. This is compounded by lack of awareness among the users and handling personnel. Pesticide containers, after the products are used up, are given out to labourers and the surrounding communities for use to draw drinking water, thus putting the farming households at risk.

#### ***PCBs***

There is no existing law/regulation that specifically prohibits/controls the importation/use of goods containing PCBs. The Environment Protection Act 2000 broadly refers to the control of environmental pollutants but does not specifically mention PCBs in relation to the provisions in the Stockholm Convention, which was signed later. The responses deduced from the survey affirm that



the presence of PCBs in some goods and their effects on human health and the environment is news to the general public. In this regard, there is an urgent need for an intensive nationwide public awareness campaign on these issues. This should be coupled with the development, enactment and enforcement of a legal policy framework that should monitor the production/importation or use of goods/equipment containing these substances, if Sierra Leoneans should be saved from their awesome environmental and health effects.

### ***UPOPs***

The most prominent sources of all were uncontrolled combustion processes in homes, dumpsites, farms/gardens, etc. The only reliable available information on the current situation at this point is the accumulation of the pollutants due to daily practices relating to their release (plastic burning, etc.)

No prevention and control mechanism was identified, although dioxins and furans are highly toxic to humans and animals; they are persistent, lasting for years or even decades before degrading into less dangerous forms; they evaporate and travel long distances through the air and through water, and they accumulate in fatty tissue;

It is very common to see Sierra Leoneans with persistent health problems yet no disease diagnosed. The environment policy should be reviewed to include management of UPOPs in the country. It should prescribe standards and enforcement strategies to help mitigate the growing levels of these pollutants. The inclusion of standards in the policy will help prevent people from contracting diseases related to UPOPs.

### ***Contaminated sites***

Hospital (medical) and pharmaceutical wastes and/or products are commonly disposed of and destroyed by open burning at sites located within the hospital compounds and very close to residential areas. The health and environmental impacts are of course tremendous. Even where incinerators were found, open burning had preference. Moyamba and Kailahun were the only district headquarter towns that had no incinerators in the hospitals.

Whereas the main municipal waste disposal sites are located within areas of settlements within the Western Area, the disposal sites in the Eastern and Southern Districts are far removed from central business areas with very minimal health and environmental impacts. The only exceptions, however, are the Kola Store dumpsite in Bo and the singular Panguma dumpsite in Kailahun. These sites together are serious health and environmental hazards to the communities in which they are situated.

Wastes containing or contaminated with PCBs from the National Power Authority (NPA) in Freetown (WA), including the massive discharges from the Chinese owned used oil refinery at Rokel and BKPS in Bo, are major health and environmental problems resulting from poor management strategies involving recycling and reuse.

In the Southern District town of Bo, the transformers units were either secured in houses or protected by fences and actually mounted on high concrete foundations that ensure minimal soil, surface water and groundwater pollutions even where leakages may occur.

Direct exposures to POPs chemicals were common at workplaces in the public as well as the private sector. The health of workers was not protected nor monitored in most (or all) places visited and inspected. This may be due to the fact that occupational health and safety mechanisms are poorly implemented in Sierra Leone as there are no trained labour related doctors to conduct medical surveillance.



Waterways (channels, drainages, and streams) are often used as disposal sites. Open burning and local flooding are common along these waterways in the dry and rainy seasons respectively.

Presently there are no appropriate national environmental and waste management strategies to reflect sound management policies, regulations and standards. The result therefore is a fragmented, duplicating and overlapping national environmental and waste management system coupled with poor logistical and financial supports from the national government.

The current capacities and capabilities relating to the legal, institutional, administrative, and technical including human resource potential are poorly developed. Consequently, there is a general lack of an effective and efficient institutional coordinating mechanism.

Most public and private industries, if not all, including small and medium scale enterprises, have no occupational health and safety programs in place for their employees. Therefore the employees and the general public are often coming under constant workplace and environmental health hazards resulting from industry-related activities to which they are exposed.

Waste management should be treated as a more important part of the national environmental management strategy. Therefore a single well-structured management mechanism that involves key sectors and all interested and affected stakeholders should be developed for Sierra Leone with a National Environment Authority as the lead agent. This authority, like the National Revenue Authority (NRA), must be represented in all sectors of the national government.

Hospital (medical) and pharmaceutical wastes, as well as other hazardous wastes, should be treated with maximum safety by personnel trained and experienced in hazardous waste management. The final disposal sites for these hazardous wastes should be located in very remote areas far from human settlements, waste bodies, national parks for wildlife and national heritages with restricted access. There should also be efficient collection and transport facilities available on a daily basis to prevent accumulation that may lead to negative health impacts.

The current national capacities and capabilities are very poorly developed, a situation that can only be changed by seeking short-to-medium-term solutions that will address the capacity development needs of all key sectors/institutions relevant to the management of POPs chemicals.

The legal institutions, both public and private, are critical for the development of the appropriate laws, policies and regulations that will adequately address the incorporation of all present-day international approaches to environmental and waste management strategies and principles including the principles of total inclusion, transparency and accountability; pollution prevention; waste minimisation; waste information system; “polluter pays” principle; best available techniques (BAT); and best environmental practices (BEP), while regulating the activities of industries including small and medium sized enterprises. Capacity development in the areas of waste and contaminated sites management is crucial for human health and the environment. Human resource development will involve professional training in all relevant environmental disciplines such as environmental law, analytical environmental chemistry, environmental hydrogeology, environmental engineering, health and occupational safety, ecotoxicology and epidemiology, etc.

### ***Public information, awareness and education***

There have been several attempts at pointing out environmental degradation by interested NGOs and the Government through public involvement and information, awareness and education. There used to be nature clubs in schools, the “Enviroscope” programme on Sierra Leone Broadcasting Station Television (SLBSTV) and now, Environmental Journalists. But even so, the POPs issue is yet to be





singled out and given the prominence it deserves as far as public awareness is concerned.

Challenges are the low level of public knowledge about POPs, the lack of sufficient information material, the insufficiency of POPs specific awareness programmes, the lack of data on POPs containing pollutants and the limitations on use of information outlets.

Education on POPs should be included in school curricula; policy makers and other target groups should be regularly trained.

Specific suggestions for awareness-raising include:

- Increased awareness-raising programs at regular intervals using radio folklore and mime
- Inclusion of importers, dealers and users of POPs containing chemicals in awareness-raising programmes
- Encouraging other interested NGOs, ministries, departments, agencies and civil society groups in awareness-raising on POPs and other pollutants
- Building, improving and regularly updating a database on POPs and other pollutants with a trained data based manager
- Ensuring experience sharing with other countries
- Increased support for information generation and dissemination
- Creation of a website by NaCEF for POPs information
- Identification of more risk communities for regular sensitisation visits
- Provision of affordable and accessible alternatives to POPs emitting substances.

### **Overview of national priorities**

The Government of Sierra Leone has decided to develop action plans to reduce or eliminate the chemicals described in Annexes A and B of the Stockholm Convention, following the priorities in its greater policy orientation towards the Millennium Development Goals (MDG). The main priority issues identified by the stakeholders grouped into five major areas are: strengthening the legal and institutional framework for management of POPs and other agricultural and industrial chemicals, facility development for PCBs disposal, establishing coordinating mechanisms for UPOPs management, establishing better environmental practices to manage POPs pesticides, and creating public information, awareness and education tools and mechanisms on POPs.

### **Identified priority areas by stake holders**

#### **A. Legal framework**

- 1) Establishing laws governing the importation, storage, use and disposal of POPs pesticides
- 2) Creating a law enforcing body on POPs pesticides regulations
- 3) Building the capacity of the law enforcing body on POPs pesticides

#### **B. Sensitisation/awareness rising**

- 1) Sensitising the public on the importation, storage, use and disposal of POPs pesticides and their containers



- 2) Sensitising the public on the effects of POPs pesticides on the human health

### **C. Capacity building**

- 1) Strengthening of existing laboratories to ensure effective data analysis of POPs pesticides
- 2) Developing effective methods of use, storage and disposal of POPs pesticides and their empty containers
- 3) Developing an effective monitoring and evaluation mechanism to update inventories of POPs pesticides

### **D. Implementation**

- 1) Involvement of all stakeholders in POPs management under the supervision of the law enforcing body
- 2) Development of alternatives to POPs pesticides through research

### ***PCBs and UPOPs***

- 1) Strengthening the relevant institutions, e.g., universities, Ministry of Lands, Housing and Country Planning and the Environment (specially the Environment Protection Department) and the Standards Bureau.
- 2) Keeping and updating inventories of PCBs and UPOPs
- 3) Minimising the effects of PCBs and UPOPs on human health and the living environment

#### *PCBs*

- Legal decommissioning and proper disposal of transformers and replacement of PCB-containing transformers or their oil

#### *UPOPs*

- Sensitisation campaign
- Community training and advocacy
- Mainstreaming best management practices into development plans
- Technology shopping, prototyping and popularisation of less hazardous energy sources for cooking
- Sensitizing women and promoting the use of the new technology
- Minimising the importation and use of leaded fuel, and fixing standards for importation of used vehicles and automobiles through advocacy and information dissemination
- Advocating the enforcement of the public smoking law



## POPs contaminated sites

### *Sensitisation on health and environmental impacts*

- Identification/involvement of stakeholders
- Seminars
- Workshops
- Conferences

### *Capacity building/strengthening requirements*

- Remediation of existing contaminated sites
- Waste management facilities
- Hospital/medical wastes
- Pharmaceutical wastes
- Municipal wastes
- Industrial wastes with emphasis on PCBs
- Health and environmental monitoring capabilities
- Information management capacities
- Institutional and legal framework

## Institutional policy and regulatory framework

- 1) Enacting laws to govern POPs chemicals Management – the Law should provide for the institutional and administrative arrangement of a National POPs centres
- 2) Harmonising policies at the sub-regional level to enhance regional inspection at entry points
- 3) Development of a National Action Plan for NIP Implementation and to include a National Monitoring Plan for effective evaluation
- 4) Domestication of the Stockholm Convention into the national legal instruments
- 5) Capacity building
  - POPs centre (laboratory, equipment, logistics, etc.)
  - Recruitment & training
- 6) Financial resource mobilisation (at national and international levels)
- 7) Technical assistance provision under the MEAs
- 8) Research
  - Determination of levels of POPs in marine and fresh water environments and fisheries
  - Promoting non-chemical alternatives to current uses of chemicals
  - Research into traditional systems for awareness-raising, information dissemination and education



- Research into existing customs and conventions with a view to review and upgrade current/obsolete laws, regulations standards, customs and conventions

### **Awareness-raising and sensitisation priority setting**

- 1) Raising public awareness on the Stockholm Convention on POPs
- 2) Capacity Building
  - Organising district/council Task Teams
  - Identification of target groups (specific)
- 3) Information materials
  - Organising awareness-raising information materials
  - Setting up a task team for development of materials for sensitisation
  - Workshops on materials development
  - Distribution of materials
- 4) Implementation of awareness-raising programmes
  - Development of skills, jingles, billboards
  - Radio discussions
  - Meeting with parliamentarians and policy making and implementing institutions
  - Conducting quizzes/essays (educational institutions and public)



## Implementation timetable and target milestones

The timeframe of the NIP implementation is 17 years starting 2008. The timeframe covers short, medium and long-term actions. Other measures will be incorporated during the implementation period. The targeted milestones for each specific theme are outline below:

**Table 2: Target milestones and timeframe of implementation**

Thematic Area	Timeframe	Target Milestones(s)
1. Regulatory and institutional strengthening measures	2008 - 2010	Coordination centre on the management POPs and other chemicals in the country strengthened by 2008 Legislation on agricultural and industrial chemicals established by 2010
2. Public information, awareness and education	2008 - 2025	Information, awareness and education of the public on POPs promoted and facilitated by 2008 Training, education and awareness programmes operational by 2009
3. Polychlorinated biphenyls (PCBs)	2008 - 2018	Disposal of PCBs contaminated equipment effected by 2017 Database of PCBs improved by 2012
4. DDT	2008 - 2012	Management strengthened and controlled by 2012
5. PCDD/PCDF	2008 - 2025	Emissions of UPOPs controlled by 2013
6. Contaminates sites	2008 - 2007	Awareness creation programmes established by 2009 Sites contaminated by POPs cleaned up by 2017 Database on contaminated sites established by 2011
7. POPs pesticides	2008 - 2017	Use of alternatives to POPs pesticides improved by 2013
8. Register of specific exemptions	2008 - 2012	Safe disposal of POPs pesticides effected by 2017
9. Information exchange	2009 - 2014	Information database on POPs established by 2009 Accessibility and information dissemination enhanced by 2014
10. Effective evaluation	2010	Strengthened monitoring and evaluation capacity by 2010
11. Reporting mechanism	2008 - 2025	Inter-institutional reporting capacity enhanced by 2009 Timely reporting according to the Convention's obligations assured by 2008



## FINANCIAL REQUIREMENTS FOR THE ACTION PLANS

The total budget for NIP implementation is US D 11,706,000 over a period of 15 years commencing 2008 to 2023. Funds will be secured from internal and external sources.

**Table 3: Financial requirements for the implementation of the action plans**

Description	Cost in USD
1. Regulatory and institutional framework	415,000
2. Public information, awareness and education	1,168,000
3. Polychlorinated biphenyls	3,155,000
4. UPOPs	1,310,000
5. Contaminated sites	1,661,000
6. POPs Pesticides	2,006,000
7. DDT	210,000
8. Register of specific exemption	54,000
9. Information exchange	190,000
10. Effective evaluation	45,000
11. Reporting mechanism	100,000
12. Research and development	1,150,000
13. Technical and financial assistance	145,000
<b>Grand Total</b>	<b>11,609,000</b>



## 1. INTRODUCTION

### 1.1. Persistent Organic Pollutants and their Properties

Persistent Organic Pollutants (POPs) are highly toxic chemicals of mostly anthropogenic origin that resist photolytic, chemical and biological degradation and cause an array of adverse effects, notably death, disease and birth defects among humans and animals. They concentrate in fatty tissues of living organisms through processes of bioaccumulation and bio-magnification. Concentrations are magnified up the food chain. For example, fish, predatory birds, mammals and humans, who are higher in the food chain, absorb the greatest concentrations of POPs.

POPs are widely distributed in the environment due to their persistence and mobility. They are literally everywhere in the world including the Arctic, Antarctica and the remote Pacific Islands. POPs occur in the tissues of every human being on earth. They evaporate and can therefore be transported by air and also as adsorbate on particles. The so-called “grasshopper effect” in which POPs condense on surfaces at low temperatures, evaporate at high temperatures, and are transported into the air to condense when the temperature drops, contributes to their distribution. In water POPs are adsorbed on sediments. Certain processes, including dredging of estuaries, may lead to their release into the water column and their subsequent transport much further afield.

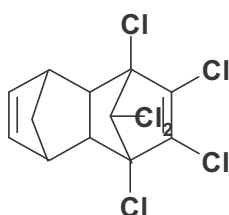
Laboratory studies have revealed that POPs cause tumours in animals and may be carcinogenic in man. They alter reproductive processes at very low concentrations, and occupational exposure in humans may result in a skin condition called “chloracne”. Loss of body weight, impaired immune response, impaired liver function and adverse effects on the central nervous system are among the health effects associated with PCBs. Human exposure routes include direct skin contact, ingestion in contaminated food and inhalation of contaminated dust. In the body, PCBs are primarily stored in the adipose (fat) tissue but have also been found in blood serum and breast milk. Individuals who have no direct contact with PCBs have been contaminated through the food chain.

Environmental degradation of PCBs is rather slow and the rate decreases with increase in chlorine content. The degrading processes include hydrolysis and microbial processes. In anaerobic conditions, reductive de-chlorination to lower chlorinated congeners facilitates subsequent microbial degradation. Bio-concentration in marine organisms can result in 200 - 70,000 times the average PCB level in the open ocean.

At present twelve chemicals have been proved to exhibit POPs characteristics and these chemicals are divided into three categories.

#### Pesticides

##### Aldrin



**Chemical Name:** 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo, exo-5,8-dimethanonaphthalene (C<sub>12</sub>H<sub>8</sub>Cl<sub>6</sub>).

**CAS Number:** 309-00-2

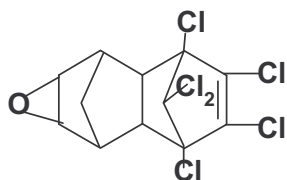
**Properties:** Solubility in water: 27 µg/L at 25°C; vapour pressure: 2.3 x 10<sup>-5</sup> mm Hg at 20°C; log KOW: 5.17- 7.4.

**Discovery/Uses:** It has been manufactured commercially since 1950, and used throughout the world up to the early 1970s to control soil pests such as corn rootworm, wireworms, rice water weevil, and grasshoppers. It has also been used to protect wooden structures from termites.

**Persistence/Fate:** Readily metabolised to dieldrin by both plants and animals. Biodegradation is expected to be slow and it binds strongly to soil particles, and is resistant to leaching into groundwater. Aldrin was classified as moderately persistent with half-life in soil and surface waters ranging from 20 days to 1.6 years.

**Toxicity:** Aldrin is toxic to humans; the lethal dose for an adult has been estimated to be about 80 mg/kg body weight. The acute oral LD<sub>50</sub> in laboratory animals is in the range of 33 mg/kg body weight for guinea pigs to 320 mg/kg body weight for hamsters. The toxicity of aldrin to aquatic organisms is quite variable, with aquatic insects being the most sensitive group of invertebrates. The 96-h LC<sub>50</sub> values range from 1-200 µg/L for insects, and from 2.2-53 µg/L for fish. The maximum residue limits in food recommended by FAO/WHO varies from 0.006 mg/kg milk fat to 0.2 mg/kg meat fat. Water quality criteria from 0.1 to 180 µg/L have been published.

### Dieldrin



**Chemical Name:** 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydroexo-1,4-endo-5,8-dimethanonaphthalene (C<sub>12</sub>H<sub>8</sub>Cl<sub>6</sub>O).

**CAS Number:** 60-57-1

**Properties:** Solubility in water: 140 µg/L at 20°C; vapour pressure: 1.78 x 10<sup>-7</sup> mm Hg at 20°C; log KOW: 3.69-6.2.

**Discovery/Uses:** It appeared in 1948 after World War II and was used mainly to control termites and textile pests, as well as soil insects such as corn rootworms, wireworms and cat worms.

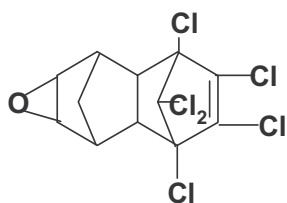
**Persistence/Fate:** It is highly persistent in soils, with a half-life of 3-4 years in temperate climates, and bioconcentrates in organisms. The persistence in air has been estimated at 4-40 hrs.

**Toxicity:** The acute toxicity for fish is high (LC<sub>50</sub> between 1.1 and 41 mg/L) and moderate for mammals (LD<sub>50</sub> in mouse and rat ranging from 40 to 70 mg/kg body weight). However, a daily administration of 0.6mg/kg to rabbits adversely affected the survival rate. Aldrin and dieldrin mainly affect the central nervous system but there is no direct evidence that they cause cancer in humans. The maximum residue limits in food recommended by FAO/WHO varies from 0.006 mg/kg milk fat and 0.2 mg/kg poultry fat. Water quality criteria from 0.1 to 18 µg/L have been published.





## Endrin



**Chemical Name:** 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth[2,3-b]oxirene (C<sub>12</sub>H<sub>8</sub>Cl<sub>6</sub>O).

**CAS Number:** 72-20-8

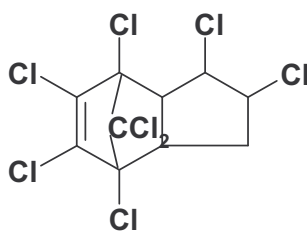
**Properties:** Solubility in water: 220-260 µg/L at 25 °C; vapour pressure: 2.7 x 10<sup>-7</sup> mm Hg at 25°C; log KOW: 3.21-5.34

**Discovery/Uses:** It has been used since the 1950s against a wide range of agricultural pests, mostly on cotton but also on rice, sugar cane, maize and other crops. It has also been used as a rodenticide.

**Persistence/Fate:** Is highly persistent in soils (half-lives of up to 12 years have been reported in some cases). Bioconcentration factors of 14 to 18,000 have been recorded in fish, after continuous exposure.

**Toxicity:** Endrin is very toxic to fish, aquatic invertebrates and phytoplankton; the LC<sub>50</sub> values are mostly less than 1 µg/L. The acute toxicity is high in laboratory animals, with LD<sub>50</sub> values of 3-43 mg/kg, and a dermal LD<sub>50</sub> of 5-20 mg/kg in rats. Long-term toxicity in the rat has been studied over two years and a NOEL of 0.05 mg/kg bw/day was found.

## Chlordane



**Chemical Name:** 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene (C<sub>10</sub>H<sub>6</sub>Cl<sub>8</sub>).

**CAS Number:** 57-74-9

**Properties:** Solubility in water: 56 µg/L at 25°C; vapour pressure: 0.98 x 10<sup>-5</sup> mm Hg at 25°C; log KOW: 6.00.

**Discovery/Uses:** Chlordane appeared in 1945 and was used primarily as an insecticide for control of cockroaches, ants, termites, and other household pests. Technical chlordane is a mixture of at least 120 compounds. Of these, 60-75% are chlordane isomers, the remainder being related to endo-compounds including heptachlor, nonachlor, Diels-Alder adduct of cyclopentadiene and penta/hexa/octachlorocyclopentadienes.

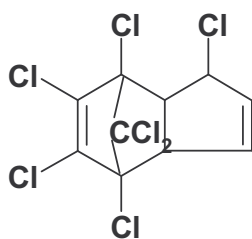
**Persistence/Fate:** Chlordane is highly persistent in soils with a half-life of about 4 years. Its



persistence and high partition coefficient promotes binding to aquatic sediments and bioconcentration in organisms.

**Toxicity:** LC<sub>50</sub> from 0.4 mg/L (pink shrimp) to 90 mg/L (rainbow trout) have been reported for aquatic organisms. The acute toxicity for mammals is moderate with an LD<sub>50</sub> in rat of 200-590 mg/kg body weight (19.1 mg/kg body weight for oxychlordan). The maximum residue limits for chlordane in food are, according to FAO/WHO between 0.002 mg/kg milk fat and 0.5 mg/kg poultry fat. Water quality criteria from 1.5 to 6 µg/L have been published. Chlordane has been classified as a substance for which there is evidence of endocrine disruption in an intact organism and possible carcinogenicity to humans.

### Heptachlor



**Chemical Name:** 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene (C<sub>10</sub>H<sub>5</sub>Cl<sub>7</sub>).

**CAS Number:** 76-44-8

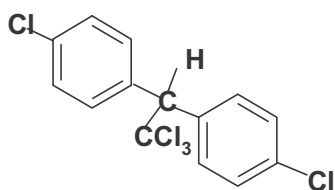
**Properties:** Solubility in water: 180 µg/L at 25°C; vapour pressure: 0.3 x 10<sup>-5</sup> mm Hg at 20°C; log KOW: 4.4-5.5.

**Production/Uses:** Heptachlor is used primarily against soil insects and termites, but also against cotton insects, grasshoppers, and malaria mosquitoes. Heptachlor epoxide is a more stable breakdown product of heptachlor.

**Persistence/Fate:** Heptachlor is metabolised in soils, plants and animals to heptachlor epoxide, which is more stable in biological systems and is carcinogenic. The half-life of heptachlor in soil is in temperate regions 0.75 – 2 years. Its high partition coefficient provides the necessary conditions for bioconcentrating in organisms.

**Toxicity:** The acute toxicity of heptachlor to mammals is moderate (LD<sub>50</sub> values between 40 and 119 mg/kg have been published). The toxicity to aquatic organisms is higher and LC<sub>50</sub> values down to 0.11 µg/L have been found for pink shrimp. Limited information is available on the effects in humans and studies are inconclusive regarding heptachlor and cancer. The maximum residue levels recommended by FAO/WHO are between 0.006 mg/kg milk fat and 0.2 mg/kg meat or poultry fat.

### Dichlorodiphenyltrichloroethane (DDT)



**Chemical Name:** 1,1,1-Trichloro-2,2-bis-(4-chlorophenyl)-ethane (C<sub>14</sub>H<sub>9</sub>Cl<sub>5</sub>).



**CAS Number:** 50-29-3.

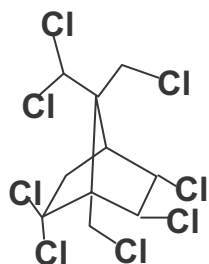
**Properties:** Solubility in water: 1.2-5.5 µg/L at 25°C; vapour pressure:  $0.2 \times 10^{-6}$  mm Hg at 20°C; log KOW: 6.19 for *p,p'*-DDT, 5.5 for *p,p'*-DDD and 5.7 for *p,p'*-DDE.

**Discovery/Use:** DDT appeared for use during World War II to control insects that spread diseases like malaria, dengue fever and typhus. Following this, it was widely used on a variety of agricultural crops. It continues to be applied against mosquitoes in several countries to control malaria. The technical product is a mixture of about 85% *p,p'*-DDT and 15% *o,p'*-DDT isomers.

**Persistence/Fate:** DDT is highly persistent in soils with a half-life of up to 15 years and of 7 days in air. It also exhibits high bioconcentration factors (in the order of 50,000 for fish and 500,000 for bivalves). In the environment, the product is metabolised mainly to DDD and DDE.

**Toxicity:** The lowest dietary concentration of DDT reported to cause egg shell thinning was 0.6 mg/kg for the black duck. LC<sub>50</sub> of 1.5 mg/L for largemouth bass and 56 mg/L for guppy have been reported. The acute toxicity of DDT for mammals is moderate with an LD<sub>50</sub> in rat of 113-118 mg/kg body weight. DDT has been shown to have an estrogen-like activity, and possible carcinogenic activity in humans. The maximum residue level in food recommended by WHO/FAO range from 0.02 mg/kg milk fat to 5 mg/kg meat fat. Maximum permissible DDT residue levels in drinking water (WHO) is 1.0 µg/L.

### Toxaphene



**Chemical Name:** Polychlorinated bornanes and camphenes (C<sub>10</sub>H<sub>10</sub>Cl<sub>8</sub>).

**CAS Number:** 8001-35-2

**Properties:** Solubility in water: 550 µg/L at 20°C; vapour pressure:  $3.3 \times 10^{-5}$  mm Hg at 25°C; log KOW: 3.23-5.50.

**Discovery/Uses:** Toxaphene, also called camphechlor, has been in use since 1949 as a nonsystemic insecticide with some acaricidal activity, primarily on cotton, cereal grains fruits, nuts and vegetables. It was also used to control livestock ectoparasites such as lice, flies, ticks, mange, and scab mites. The technical product is a complex mixture of over 300 congeners, containing 67-69% chlorine by weight.

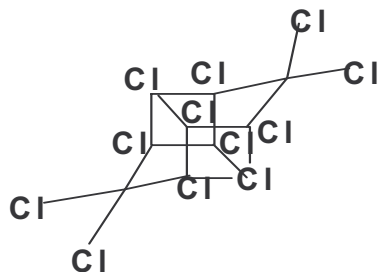
**Persistence/Fate:** Toxaphene has a half-life in soil from 100 days up to 12 years. It has been shown to bioconcentrate in aquatic organisms (BCF of 4247 in mosquito fish and 76000 in brook trout).

**Toxicity:** Toxaphene is highly toxic in fish, with 96-hour LC<sub>50</sub> values in the range of 1.8 µg/L in rainbow trout to 22 µg/L in bluegill. Long term exposure to 0.5 µg/L reduced egg viability to zero. The acute oral toxicity is in the range of 49 mg/kg body weight in dogs to 365 mg/kg in guinea pigs. In long term studies NOEL in rats was 0.35 mg/kg bw/day, LD<sub>50</sub> ranging from 60 to 293 mg/kg bw.



For toxaphene exists a strong evidence of the potential for endocrine disruption. Toxaphene is carcinogenic in mice and rats and is of carcinogenic risk to humans, with a cancer potency factor of 1.1 mg/kg/day for oral exposure.

### Mirex



**Chemical Name:** 1,1a,2,2,3,3a,4,5,5a,5b,6-Dodecachloroacta-hydro-1,3,4-metheno-1Hcyclobuta[cd]pentalene (C<sub>10</sub>Cl<sub>12</sub>).

**CAS Number:** 2385-85-5

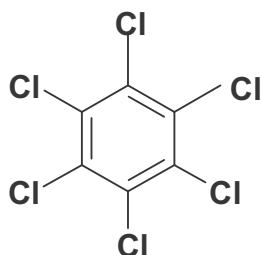
**Properties:** Solubility in water: 0.07 µg/L at 25°C; vapour pressure: 3 x 10<sup>-7</sup> mm Hg at 25°C; log KOW: 5.28.

**Discovery/Uses:** The use in pesticide formulations started in the mid 1950s largely focused on the control of ants and termites. It is also a fire retardant for plastics, rubber, paint, paper and electrical goods. Technical grade preparations of mirex contain 95.19% mirex and 2.58% chlordecone, the rest being unspecified. Mirex is also used to refer to bait comprising corncob grits, soy bean oil, and mirex.

**Persistence/Fate:** Mirex is considered to be one of the most stable and persistent pesticides, with a half-life in soils of up to 10 years. Bioconcentration factors of 2,600 and 51,400 have been observed in pink shrimp and fathead minnows, respectively. It is capable of undergoing long-range transport due to its relative volatility (VPL = 4.76 Pa; H = 52 Pa m<sup>3</sup>/mol).

**Toxicity:** The acute toxicity of mirex for mammals is moderate with an LD<sub>50</sub> in rat of 235 mg/kg and dermal toxicity in rabbits of 80 mg/kg. Mirex is also toxic to fish and can affect their behaviour (LC<sub>50</sub> [96 hr] from 0.2 to 30 mg/L for rainbow trout and bluegill, respectively). Delayed mortality of crustaceans occurred at 1 µg/L exposure levels. There is evidence of its potential for endocrine disruption and possibly carcinogenic risk to humans.

### Hexachlorobenzene (HCB)



**Chemical Name:** Hexachlorobenzene (C<sub>6</sub>H<sub>6</sub>).

**CAS Number:** 118-74-1



**Properties:** Solubility in water: 50 µg/L at 20°C; vapour pressure:  $1.09 \times 10^{-5}$  mm Hg at 20°C; log KOW: 3.93-6.42.

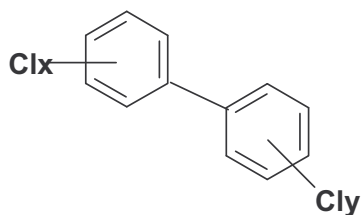
**Discovery/Uses:** It was first introduced in 1945 as fungicide for seed treatments of grain crops, and used to make fireworks, ammunition, and synthetic rubber. Today it is mainly a by-product in the production of a large number of chlorinated compounds, particularly lower chlorinated benzenes, solvents and several pesticides. HCB is emitted to the atmosphere in flue gases generated by waste incineration facilities and metallurgical industries.

**Persistence/Fate:** HCB has an estimated half-life in soils of 2.7-5.7 years and of 0.5-4.2 years in air. HCB has a relatively high bioaccumulation potential and long half-life in biota.

**Toxicity:** LC<sub>50</sub> for fish varies between 50 and 200 µg/L. The acute toxicity of HCB is low with LD<sub>50</sub> values of 3.5 mg/g for rats. Mild effects on the rat liver have been observed at a daily dose of 0.25 mg HCB/kg bw. HCB is known to cause liver disease in humans (porphyria cutanea tarda) and has been classified as a possible carcinogen to humans by IARC.

## Industrial chemicals and UPOPs

### Polychlorinated biphenyls (PCBs)



**Chemical Name:** Polychlorinated biphenyls (C<sub>12</sub>H<sub>(10-n)</sub>Cl<sub>n</sub>, where n is within the range of 1 - 10).

**CAS Number:** Various (e.g., for Aroclor 1242, CAS No.: 53469-21-9; for Aroclor 1254, CAS No.: 11097-69-1);

**Properties:** Water solubility decreases with increasing chlorination: 0.01 to 0.0001 µg/L at 25°C; vapour pressure:  $1.6-0.003 \times 10^{-6}$  mm Hg at 20°C; log KOW: 4.3-8.26.

**Discovery/Uses:** PCBs were introduced in 1929 and were manufactured in different countries under various trade names (e.g., Aroclor, Clophen, Phenoclor). They are chemically stable and heat resistant, and were used worldwide as transformer and capacitor oils, hydraulic and heat exchange fluids, and lubricating and cutting oils. Theoretically, a total of 209 possible chlorinated biphenyl congeners exist, but only about 130 of these are likely to occur in commercial products.

**Persistence/Fate:** Most PCB congeners, particularly those lacking adjacent unsubstituted positions on the biphenyl rings (e.g., 2,4,5-, 2,3,5- or 2,3,6-substituted on both rings) are extremely persistent in the environment. They are estimated to have half-lives ranging from three weeks to two years in air and, with the exception of mono- and di-chlorobiphenyls, more than six years in aerobic soils and sediments. PCBs also have extremely long half-lives in adult fish, for example, an eight-year study of eels found that the half-life of CB153 was more than ten years.

**Toxicity:** LC<sub>50</sub> for the larval stages of rainbow trout is 0.32 µg/L with a NOEL of 0.01 µg/L. The acute toxicity of PCB in mammals is generally low and LD<sub>50</sub> values in rat of 1g/kg bw. IARC has concluded that PCBs are carcinogenic to laboratory animals and probably also for humans. They



have also been classified as substances for which there is evidence of endocrine disruption in an intact organism.

### Polychlorinated dibenzo-p-dioxins (PCDDs) and Polychlorinated dibenzofurans (PCDFs)



**Chemical Name:** PCDDs ( $C_{12}H_{(8-n)}Cl_nO_2$ ) and PCDFs ( $C_{12}H_{(8-n)}Cl_nO$ ) may contain between 1 and 8 chlorine atoms. Dioxins and furans have 75 and 135 possible positional isomers, respectively.

**CAS Number:** Various (2,3,7,8-TetraCDD: 1746-01-6; 2,3,7,8-TetraCDF: 51207-31-9)

**Properties:** Solubility in water: in the range 0.43 – 0.0002 ng/L at 25°C; vapour pressure: 2-0.007 x 10<sup>-6</sup> mm Hg at 20°C; log KOW: in the range 6.60 – 8.20 for tetra- to octa-substituted congeners.

**Discovery/Uses:** They are by-products resulting from the production of other chemicals and from the low temperature combustion and incineration processes. They have no known use.

**Persistence/Fate:** PCDD/Fs are characterised by their lipophilicity, semi-volatility and resistance to degradation (half-life of TCDD in soil of 10-12 years) and to long-range transport. They are also known for their ability to bioconcentrate and biomagnify under typical environmental conditions.

**Toxicity:** The toxicological effects reported refers to the 2,3,7,8-substituted compounds (17 congeners) that are agonist for the AhR. All the 2,3,7,8-substituted PCDDs and PCDFs plus coplanar PCBs (with no chlorine substitution at the ortho positions) show the same type of biological and toxic response. Possible effects include dermal toxicity, immunotoxicity, reproductive effects and teratogenicity, endocrine disruption and carcinogenicity. At the present time, the only persistent effect associated with dioxin exposure in humans is chloracne. The most sensitive groups are foeti and neonatal infants. Effects on the immune systems in the mouse have been found at doses of 10 ng/kg bw/day, while reproductive effects were seen in rhesus monkeys at 1-2 ng/kg bw/day. Biochemical effects have been seen in rats down to 0.1 ng/kg bw/day. In a re-evaluation of the TDI for dioxins, furans (and planar PCBs), the WHO decided to recommend a range of 1-4 TEQ pg/kg bw, although more recently the acceptable intake value has been set monthly at 1-70 TEQ pg/kg bw.

#### 1.2. Purpose of the National Implantation Plan

The National Implementation Plan (NIP) for Sierra Leone is prepared to elaborate the current situation on POPs and formulate the commitment and actions that the country intends to undertake in the management and control of POPs for the period of 17 years beginning 2008. Moreover, it should enable Sierra Leone to meet its obligations under the Stockholm Convention on Persistent Organic Pollutants. Article 7 of the Convention requires the Parties to the Convention to develop a national implementation plan to meet the requirements of the Convention and communicate such plan to the Conference of Parties (COP) within two years of the coming into force of the Convention for the Party. Sierra Leone will therefore integrate the NIP into the national sustainable development plans where necessary.

The main objective of the NIP is to prepare comprehensive and realistic action plans for effective management of POPs chemicals and to reduce and or eliminate the use and release of POPs.



The development of the NIP is intended to yield the following objectives:

- a) To achieve the commitment of the Government to the objectives of the Stockholm Convention for effective management of POPs chemicals;
- b) To provide the basis for monitoring the action plans and strategies Sierra Leone has committed to undertake;
- c) To build a basis for periodical reviewing and updating of the NIP as appropriate and in a manner to be specified by a decision of the Conference of Parties;
- d) To utilise and, where necessary, establish the means to integrate appropriately the national implementation plan for persistent organic pollutants into the sustainable development strategies;
- e) To cooperate directly or through global, regional and sub-regional organisations, and consult the national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of the NIP;
- f) To facilitate public awareness, education and participation in POPs management issues, and overall improvement in environmental and public health protection.

### *1.3. The Lead Agency in the Preparation of the NIP*

The Department of Environment Protection in the National Commission on Environment and Forestry (NaCEF) is the National Focal Point to the Stockholm Convention and is the National Lead Agency in the preparation of the National Implementation Plan (NIP). The department acts as the focal point for all national and international environmental issues relating to Sierra Leone and has the responsibility to coordinate and monitor the implementation of all environmental policies, programmes, projects and activities. It is empowered under the Environment Protection Act (EPA), 2000 to put in place all necessary mechanisms and environmental standards and legislation to protect and manage the environment and its natural resources. The drafting of the NIP involved the Project Coordinating Unit (PCU), National Technical Experts comprising 10 experts from relevant sector ministries, government agencies, academic and research institutions and NGOs.

Following the enactment of the draft POPs legislation for the implementation of the Convention, the Environment Department will now have a clear-cut mandate and institutional framework for sound chemical and environmental management in the country. The POPs legislation will provide decisive policy, legal and institutional basis for efficient and effective implementation of the NIP. Moreover, the act will provide an opportunity for linkages and synergies to other relevant programmes and policy initiatives at sector and local authorities levels. The act will also include relevant sectors and local authorities and provide them with responsibility on environmental management as enshrined in the National Environmental Policy (NEP).

The process of developing a NIP is divided into five phases:

1. Establishment of a coordinating mechanism and process organisation;
2. Establishment of POPs inventories and assessment of national infrastructure and capacity;
3. Priority assessment and objective setting;
4. Formulation of the NIP;
5. Endorsement and submission of the NIP.



During the inventory of POPs, most of the stakeholders had the opportunity to provide baseline information through questionnaires, community visits and inter-ministerial contacts. Stakeholders also played an immense role in reviewing the inventory reports in workshops. Three national stakeholders' workshops were organised, namely the project inception, inventory report validation and priority assessment and objective setting workshops. Three task team training workshops were also organised: Inventory training, NIP development, and UNITAR supported training on Action Plan development and POPs legislation development for the implementation of the Stockholm Convention.

The endorsement of the NIP is to get the consent and reaction of stakeholders to the NIP by indicating their acceptance and giving comments (account of stakeholders inputs) to improve the NIP document through a national workshop.

#### *1.4. Assistance Received at the International Level*

Sierra Leone, being a signatory to the Stockholm Convention, received a financial help from the Global Environment Facility (GEF) through the United Nations Industrial Development Organization (UNIDO) to assist in the development of National Implementation Plan (NIP). The amount provided was US \$ 290,000 to cover the NIP preparation excluding the cost of the implementing agency (i.e. UNIDO).

UNIDO prepared the project proposal entitled "Enabling Activities to Facilitate Early Action on the Implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs)". UNIDO also provided training and the technical support for the preparation of the NIP.

UNITAR supported training on action plan development and technical backstopping.

#### *1.5. Assistance Received at the National Level*

The Government of Sierra Leone provided in kind contribution in terms of personnel and office space.





## 2. COUNTRY BASELINE

### 2.1. Country Profile

#### 2.1.1 Physiographic and demographic setting

Sierra Leone is located on the west coast of Africa and covers an area of 72,325 km<sup>2</sup>. It lies between latitudes 6°55'N and 10°00'N and longitudes 10°14'W and 13°17'W. It has a north-south distance of 331 km and an east-west distance of 326 km. It is bounded in the north and north-east by the Republic of Guinea, on the south east by Liberia and on the south-west and west by the Atlantic Ocean.

The country is divided into four main physical regions. These are the Coastal Plains, the Interior Plains, and the Interior Plateaux and the Freetown Peninsula consisting mainly of mountains and hills; each of these physiographic regions can be subdivided into a number of ecosystems. The Coastal Plains are relatively gentle and consist of estuarine swamps, beach ridges, alluvial plains and coastal terraces. The Interior Plains rise gently from an elevation of 40 m in the west to 200 m. They extend from the coastal terraces in the west to the east of Sierra Leone and occupy approximately 43% of the land area. They are separated from the Interior Plateaux region by a distinct escarpment. They are made of flat treeless grasslands known as bolilands, undulating plains and isolated hills.

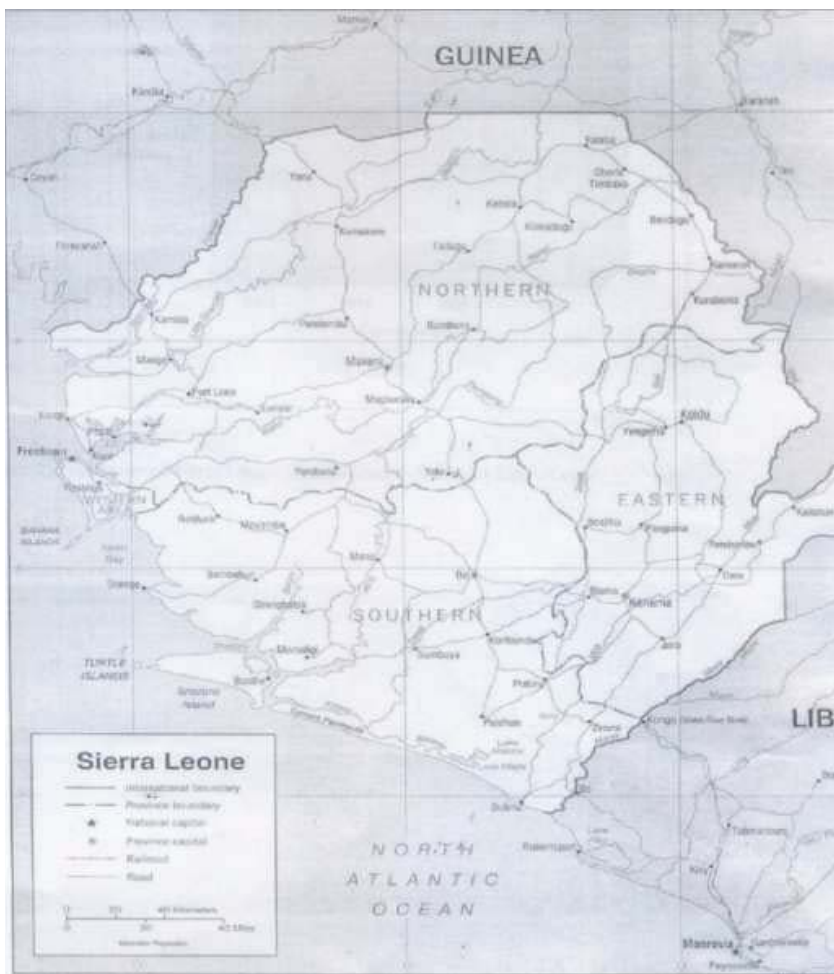


Figure 1: Map of Sierra Leone with administrative regions



The Plateaus region, which ranges in altitude from 200 m to 700 m, is found in the north-eastern and south-eastern part of the country and consists of undulating high relief and rolling plains and hills. The highest mountains are found in the north and north east of the country; the prominent ones being the Loma Mountains and the Tingi Hills. The highest peak in the Loma Mountains is the Bintumani, which rises to 1,945 m while the Sankan Biriwa on the Tingi Hills rises to 1,805 m. All the ecosystems of the Plateaux and Interior Plains account for 84% of the total land area of Sierra Leone, and have a flat to gently rolling topography.

West of the Loma Mountains and Tingi Hills, is the Freetown Peninsula, which consists of dissected mountainous peaks with Sugar Loaf and Picket Hills being the highest. They developed from basic and ultra-basic rocks, and hills of acid rock origin. Soils are moderately to well drained, and low in fertility. The Freetown Peninsula has ranges of hills, which make it unique in the sub-region and is reported to have contributed to giving Sierra Leone its original Spanish name “Sierra Loya”, meaning “Lion Mountains”.

Sierra Leone has a tropical humid climate with two distinct seasons, namely the wet season from May to October and the dry season from November to April. Diurnal temperatures vary from 25° to 34° Celsius, although they could be as low as 16° Celsius at night during the Harmattan season when the north-east trade wind blowing from the Mediterranean Sea across the Sahara desert to the Atlantic Ocean arrives on the west coast depleted of most of its moisture. The average temperatures are around 26° Celsius.

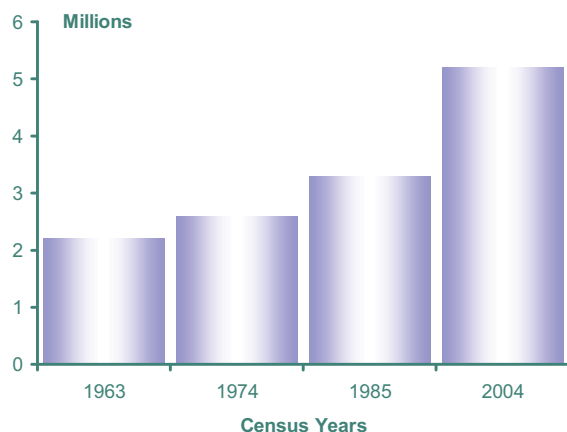
Rainfall varies both in space and time. The mean annual variability is about 20%. The average annual rainfall varies from about 2,500 mm in the drier areas of the north-west and north-east of the country to about 3,000 mm in the southeast and about 5,000 mm in the Freetown Peninsula. The rainfall pattern is unimodal with most of the rainfall occurring from late April to early November. The wettest months in most parts of the country are July and August. The heavy rains and maritime influence lead to high humidity. Relative humidity is usually about 90% in the wet seasons but drops to about 20% inland in the Harmattan season that occurs at the beginning of the dry season. Normal wind speed averages 8 knots throughout the year. There is plentiful of sunshine that varies substantially with amount of cloudiness averaging 6 - 8 hours per day during the dry season and 2 - 4 hours per day during the wet season.

The coastline is about 560 km long and the shelf covers an area of 30,000 km<sup>2</sup>. The drainage system comprises many rivers running from north to south, which include the Great Scarcies, Little Scarcies, Rokel, Jong, Moa, Sewa and Mano.

Broadly speaking, Sierra Leone can be classified into seven vegetation types, and these include moist rainforest, semi-deciduous, montane, savannah, farmbush mangroves and swamp forests. At present, the country is covered with more of mosaic secondary forests and farmbush, which arise from the slash-and-burn agricultural practices. The moist and semi-deciduous forests are found in the protected areas especially on the tops of mountains and slopes. The woodland savannah is restricted to the northern part of the country and is increasingly subjected to frequent bushfires. Swamps are found in the coastal creeks' estuaries of the Scarcies, Sierra Leone, Sherbro and Malan Rivers. Mangroves extensively cover the Atlantic coastline. Based on this classification, the country has the following six major ecosystems: Forest, Montane, Savannah, Agricultural, Wetlands and Freshwater.

The population of Sierra Leone increased from about 2.2 million in 1963 to 4.2 million in 1999. It was estimated to be 5.2 million in 2004 (Census, 2004) growing at the rate of about 2.6% per annum. Although the growth rate is relatively low compared to most Sub-Saharan countries, the population density is relatively high (58 persons per square kilometre).





**Figure 2: Population growth in Sierra Leone**

It has been estimated that 7 – 8% of the total land area is arable and suitable for cultivation of crops on a sustainable basis, while the non-arable lands cannot yield any economic returns when cultivated.

Rural life is generally at a subsistence level and over two thirds of the population live in absolute poverty. Life expectancy is very low, estimated at 42 years, and the infant mortality rate is one of the highest in the world. This situation has been worsened by the recently ended 10 year civil conflict, exacerbated by increasing urbanisation, population pressure on the available natural resources, inappropriate domestic policies and market failures. Illiteracy is very high and large sections of the population remain unemployed, especially youths. In consequence, Sierra Leone is now classified as one of the poorest and least developed countries in the world based on the United Nations Human Development Index (World Bank Report 1994).

## 2.1.2 Macroeconomic environment

The country's small open economy is predominantly agricultural and sustains about two thirds of the population at a bare subsistence level. Agriculture accounts for 47.5 percent of GDP, but in terms of export earning the mining sector is more significant than agriculture. Diamonds remain the chief export earner, with significant reserves of other minerals such as gold, rutile, bauxite, chromites and iron ore. The trade in diamonds as the principal mineral resource is exposed to smuggling and other related illegal activities. The agricultural and mining sectors coexist with the small business sector that provides services accounting for about 25.2 percent. Sierra Leone attained independence in 1961 with the immediate post-colonial era showing encouraging signs of steady economic growth around 4 percent a year during the first decade. The fiscal and foreign exchange position was healthy with a manageable single-digit inflation rate. The consequences of inadequate development efforts, ill-conceived economic policies, and the oil shocks of the 1970s all accounted for the speedy deterioration of the economic structure.

Sierra Leone suffered a major stagnation in the last three decades leading to the civil war thereafter.

### 2.1.2.1 Economic recovery effort

Since the early 1980s the Government has made several efforts at redressing the pervasive economic decline and at restoring macroeconomic stability with support from bilateral and multilateral institutions. Earlier support efforts came from an IMF Extended Fund Facility (EFF) in 1981/82 and a stand-by arrangement in 1984/85. These programmes were, however, cancelled before the full utilisation of the credits because of Government's inability to meet agreed targets. In 1986 another



IMF Support Reform Programme (SRP) focused on the adoption of a market-determined exchange rate, removal of price controls and the termination of government subsidies mainly on petroleum production. In early 1987, this programme was suspended due to political difficulties meeting targets.

Towards the latter part of 1987, the Government introduced a National Economic Emergence programme (NEEP), which imposed rigid controls on economic activity. These included exchange rate control and currency revaluation, rigid controls on currency holding, cross border trade, and controls on prices of staple products. These measures were, however by-passed. The private sector business was conducted on thriving illegal markets, thereby paving the way for smuggling of essential goods, national resources and capital flight. Faced with an increasing serious economic distress, the Government in collaboration with IMF and World Bank ushered in the Structural Adjustment Programme (SAP) for a reform of the economy in late 1989, encompassing both stabilisation and structural reforms. Stabilisation includes exchange rate and trade liberalisation, deregulation of prices and indirect mechanisms of monetary control, and prudent fiscal management. On the other hand, structural reforms were focused on restructuring the civil service to enhance its ability to deliver public services, reform public enterprises, improve on their efficiency, and develop the private sector for propelling economic growth. Other reforms in sectoral policies and strategies resulted in new decrees/acts (by the then military government) to rationalise mining operations and in the formulation of new educational, health and environmental policies.

Unlike previous reform efforts, the Structural Adjustment Programme recorded initial gains and the economy began to stabilise during the first half of the 1990s with however mixed feelings about the social consequences of the programme. The escalation of the war by the close of 1994 and early 1995 hampered the economic recovery programme as the uncertainties of rebel attacks on productive areas of the economy undermined business confidence and general economic activity. Overall, economic performance has been affected by the worsening security situation. Still prevalent to date are the legacies of economic decline, weak institutional capacities, low domestic savings and investments, high unemployment particularly among youths, high debt burden, and weak fiscal and external sector positions. The overriding consequence has been abject poverty among the wider segment of the population, with the accompanying low standards of living.

### ***2.1.2.2 Agriculture***

Sierra Leone is an agricultural country. Agriculture is the largest sector in the economy, providing employment for over 60% of the labour force, and contributing about 35% to 40% of the gross domestic product (GOSL 1994). The area under cultivation is estimated at 409,674 ha. Most of the agriculture is carried out in the upland largely by slash-burn, shifting method of farming with rice cultivation making up the bulk of the subsistence activity. Rice, the staple food, is grown by more than 80% of the farmers. Rice is grown on over 300,000 to 400,000 ha of land with an annual production of 450,000 mt. Rice alone accounts for as much as 85% of the agriculture sector's contribution of GDP. Apart from the upland ecosystem, rice is produced in 4 other distinct ecologies namely: inland valley swamps (IVS), mangrove, riverbank flood plains and bolilands. Upland rice is usually intercropped with up to 16 annual crops. Cash crops such as palm oil, cocoa, and coffee are still exported on small scale compared to countries like Cote d'Ivoire and Ghana, which have huge plantations and a large share of the world market. Livestock production is largely free range. It includes cattle, sheep, goats and pigs. In 1984 the estimates of ruminants were 33,200 heads of cattle, 264,000 sheep and 145,000 goats; there were also unspecified numbers of pigs and rabbits. The birds (poultry) include chickens, ducks, guinea fowl and pigeons. The latter are mostly kept as pets.



### **2.1.2.3 Forestry**

The contribution of forestry to national development in Sierra Leone is quantifiable as in the case of timber products and non-quantifiable as in the case of erosion control and biodiversity conservation. However, its contribution, especially the energy sector, infrastructure development, biological research, food security, employment and welfare services, etc., is significant but generally underestimated. The quantity of firewood, local building materials and even timber that is utilised by rural communities is yet to be quantified. If this is done, the estimated 6 - 7% contribution of the forestry sector to the GDP will increase. Most dwelling houses in villages utilise building poles/sticks, canes, etc. in the construction of the mud buildings.

Of the total annual round wood removals in the country, 95% by volume of the harvest is for firewood, 3% for poles and 2% for sawn timber (FAO, 1990). Assuming that 80% of the 5.2 million people in Sierra Leone residing in the rural areas use firewood for cooking at a per capital annual consumption of 1.63 m<sup>3</sup> then about 6.8 million m<sup>3</sup> of firewood has not been properly accounted for in the computation of the forestry's contribution to the GDP. Sierra Leone's woods provide the bulk of the construction timber for local construction industries. There is presently a proliferation of timber stores in the city and the provincial and district headquarters. The impact of local timber on the construction and carpentry industries could best be valued in terms of foreign exchange saved due to the availability of the commodity locally. The round wood requirements for the production of timber, poles and firewood is about 4 million m<sup>3</sup> and is rising; about 95% is utilised as fuel wood (FAO, 1982). The estimate annual round wood consumption is 2.91 million m<sup>3</sup>, 2.75 million m<sup>3</sup> of which consumed as fuel wood, 0.17 million m<sup>3</sup> for poles and 0.04 million m<sup>3</sup> as saw logs. Fuel wood demand is expected to increase at a rate of 1.8 - 2.0% per annum.

### **2.1.2.4 Fisheries**

Fishing, both marine and inland/freshwater, is an important economic activity in Sierra Leone. It is the principal source of livelihood for a large proportion of the population of the coastal villages. Fish and other seafood are important sources of protein for people. Fisheries contribute about 20% of GDP. However, industrial fisheries are primarily in the private sector. Fishery development activities are concentrated on artisanal fishermen by assisting them to improve their techniques of production and processing (such as smoking and curing of fish) and by improvement of the infrastructures of credit, storage, transport and marketing, having been undertaken in the independence period (GOSL, 1985). The fisheries division lacks the capability for effective patrolling of fishing in Sierra Leone territorial waters.

### **2.1.2.5 Tourism**

Sierra Leone has exceptional advantages for the development of tourism: a dry season of 5 to 6 months, excellent beaches, a superb landscape of villages and hills along the coast and a hinterland with a great variety of landscapes and vibrant cultures. The tourism industry is still in its infancy. The ten years civil conflict has exacerbated the slow growth and development of the sector. Most of the limited infrastructures of the tourism industry were destroyed. Before the war, in 1987/88, the number of charter tourists coming to Sierra Leone, mainly from UK and France, seemed to have reached a plateau of about 20,000 per year 1978/79. Major increase in numbers will require large investments, public and private, in hotels, physical infrastructures and various tourism related services. Already in place is the establishment of a hotel and tourism training school to address the need for trained manpower. The Freetown Peninsula Road that is under construction will improve access to the most scenic beaches in the Western Area and will also stimulate construction of hotels along the beaches.



### **2.1.2.6 Mining**

Mining is the largest productive sector, providing about 20 percent of GDP. Mining contributes more significantly to export earnings than does agriculture. The mining sector's great potential has not brought the benefits that it could produce, due to improper policies for exploiting and utilising the sector's resources. At independence the economy's prosperity was based on mining of diamonds and iron ore. While these exports initially grew, the economy began its seemingly irreversible decline, prosperity changed to stagnation, and then to continuous decline. The general inflation in primary product prices during the 1970s disguised the fall in the volume of mineral exports. In the same period, import prices rose significantly, leading to a decline in the net terms of trade. Overall, the stagnation of the mining sector generated a profoundly depressing effect on the economy.

### **2.1.3 Education**

A new system of education had been introduced. The thrust of this new system is on vocational and middle-level manpower training, catering for early school leavers, weak students and dropouts. The system provides for pupils to spend 6, 3, 3, and 4 years respectively in primary school, junior secondary school, senior secondary school and university level. Emphasis is placed on basic and non-formal primary education, with the education of the girl-child as one of the key elements. Technical and vocational training for middle level manpower is being reinforced through restructuring of tertiary education, including the establishment of polytechnics. However, the realisation of the anticipated positive impact of these reforms has been hampered by resource constraints. There is, therefore, an urgent need to pay serious attention to the resource needs of the sector, including the issues of trained qualified, well equipped and motivated teachers.

### **2.1.4 Health and sanitation**

#### **2.1.4.1 Health**

The sector has suffered the same neglect as education, as reflected by the gloomy health indicators. In 2000, the UNDP Human Development Report recorded a life expectancy of 42 years compared to 45 years for sub-Saharan African. The Mortality Indicator Cluster Survey II (MICS II) 2000 reported infant and child mortality rates of 170 and 286 per 1,000, respectively. Though these rates mark an improvement compared to the 1970s, they exceed the average for many African countries.

Women face additional health problems arising mainly from their reproductive role. Poverty, inadequate access to poor reproductive health facilities and malnutrition are the major factors for high maternal mortality, a rate currently estimated at 18 per 1,000, three times higher than the average of 6 per 1,000 for sub-Saharan Africa. Largely as a result of sex and high illiteracy rate, family planning is not widespread as reflected in the contraceptive prevalent rate of only 6%.

#### **2.1.4.2 Sanitation**

The inadequate and appalling sanitary facilities largely explain the dismal health situation. The 2000 Baseline Service Delivery Survey (BSDS) reported that about 65%, 60% and 80% of the population lack access to safe drinking water, health services and sanitation, respectively. The MICS II survey reported sewage and refuse disposal facilities to be grossly inadequate, contributing to the spread of waterborne diseases and malaria. There are also severe rural-urban disparities in access to these services. Hardly any rural village has adequate pit latrines, which poses serious health and environmental problems for the communities. The prevailing scene in the rural communities is one in which women and children fetch pails of water from crude, unsanitary hand-dug wells or standing pools of water. Wells normally run dry for a part of the year.



In the urban areas, sanitation problems arise mainly from poor systems of solid waste disposal. It is common practice for most households to dispose of refuse by dumping on the roadside, in drainages, or in backyards. The problem has been further compounded by the increasing rate of urbanisation, coupled with the inadequate infrastructure and services for solid waste disposal.

## **2.1.5 Transport**

### **2.1.5.1 Road transport**

The public road network constitutes the most important transport infrastructure, carrying roughly 80% of internal passenger and cargo traffic. The national road network totals about 11,000 km, of which some 8,000 km were functionally classified in the national road system and the remaining 3,000 as local network and as unclassified roads and tracks. Less than 1,000 km of the entire network is now paved, with at least half of these roads being in poor condition. Many formerly paved roads have reverted to gravel. Of the unpaved portion, less than 30% is in fair to good condition.

With respect to density relative to both population and quality, the road infrastructure in the country is poorly developed when compared with the situation in many other African countries. Road building and maintenance has not been given priority. The situation with feeder roads is even worse, with a large number of roads in poor condition and accessibility in most places limited to the dry season.

### **2.1.5.2 Air transport**

Air transportation is similarly underdeveloped, with only one international airport and 14 internal airstrips, of which only a few are operational. The international airport, like the internal airstrips, is ill equipped; it lacks modern facilities and infrastructure for efficient service delivery. Sierra Leone owns one national carrier, Sierra National Airlines, which is presently grounded due to operational and financial constraints. Efforts are currently underway to modernise and upgrade the international airport and internal airstrips, while serious consideration is given to the privatisation of the national airline.

### **2.1.5.3 Water transport**

River or maritime transportation is very important to the economy of Sierra Leone, given the long coastline and many navigable rivers and the high proportion of traded goods that are transported by sea and inland waterways. Even though the country has one of the best natural harbours in the world, the poor quality of port and jetty services and infrastructure limits activities and growth of the sector. River transportation is operated mainly by small boat owners, whose services are not only inefficient but also highly risky. Lack of adequate safety measures has exposed this system of transportation to a number of navigational hazards, and has accounted for several fatal accidents over the years.

## **2.1.6 Telecommunication**

Despite the increasing demand for telecommunication services, the existing fixed/land telephone network is characterised by low penetration rates and poor quality of services. The telecommunication infrastructure has not kept pace with developments in the rest of the world. While the global trend has been an increase in the digital and satellite communication, Sierra Leone continues to use out-dated equipment with low network penetration rates. However, efforts are currently being made to upgrade the existing fixed telephone networks. Presently, several private sector service providers are operating locally by providing mobile telephone services in large parts of the country. Efforts are being made to cover the entire country with mobile telephone networks.



### 2.1.7 Energy and power

Energy and power supplies have been consistently erratic and unsatisfactory over the years. The country depends on two main sources for electric power generation; fossil fuel plants accounts for about 90% of total electricity generation, while hydroelectricity accounts for the rest. The electricity sector is operated by one state owned enterprise, the National Power Authority (NPA) that performs the four separate activities of generation, transmission, distribution and supply. The existing systems are old and inefficient, resulting in substantial losses of generated energy, estimated at 30%. Electricity generation, which stood at around a peak of 196 GW hours in 1984, declined drastically to around 25 - 30 GW hours in 2000. Poor power supplies have increased the use of small petrol/diesel driven generators, with significant cost overheads for both individuals and private sector enterprises.

Sierra Leone has a high potential for generating hydroelectric power. The long overdue Bumbuna Hydro Electricity Project inaugurated in the early 1970s when completed in 2007 should generate sufficient power initially to supply Freetown and the Northern Provincial towns of Makeni, Magburaka, Lunsar and later other parts of the country. There is a mini-hydroelectric plant at Dodo in the Eastern Province that provides electricity to the provincial headquarters towns of Kenema and Bo.

### 2.1.8 Environment

Sierra Leone is presently faced with the problem of environmental degradation arising mainly from demographic, economic and social pressures. Poor economic performance, rapid population increase, migration, and poverty have led to increasing demands on the physical environment with consequences of rapid deforestation and with degradation and uncontrolled exploitation of natural resources. Deforestation accounts to a large extent for the environmental degradation in the country. The traditional farming practice of shifting cultivation, with declining fallow periods, has over the years left vast expanses of land deforested in much of the country. About 600,000 ha or 8% of Sierra Leone's total area is arable land. The problem is further exacerbated by the overwhelming dependence of the population on fuel as the main source of energy for cooking and baking and in cottage industry. About 4 million cubic meters of wood biomass is extracted annually to meet domestic energy needs. While uplands continues to be the principal source of fuel wood and construction materials, mangroves in the coastal areas are being increasingly exploited for fuel woods, boat construction, and rice cultivation. This has led to increasing exposures to storms and destruction of natural breeding grounds for marine and estuarine fish and other organisms.

In the northern region of Sierra Leone where 60% of the cattle and small ruminant population is concentrated, over 8,300 km<sup>2</sup> of land has been left bare due to overgrazing. There are no attempts at any form of range and pasture management. Bushfires continue to affect about 200,000 ha of savannah woodlands annually. Thus, overgrazing and annual bush fires have caused an apparent ecological change from savannah woodland to grassland in the cattle rearing areas.

Mining activities, particularly in the eastern and southern regions, have also left vast areas deforested and degraded. It is estimated that between 80,000 and 120,000 ha have been mined in different parts of the country with minimal efforts at reclamation. The uncontrolled exploitation of mineral resources, especially diamond and gold, coupled with the absence of mitigating policies and conservation programmes over the years, has resulted in devastating environmental consequences.





## 2.2. Institutional, Policy and Regulatory Framework

### 2.2.1 Environmental and sustainable development policy and general legislative framework

#### 2.2.1.1 Legislation formulation process

The process of formulating national laws is initiated by the relevant ministries or commissions which prepare draft legislation/policy. The draft legislation/policy is then normally circulated to various stakeholders who are invited to make inputs through regional and national workshops in order to achieve refinement and build consensus. The draft legislation is then submitted to the Cabinet via the relevant supervising ministry; it is then deliberated upon by the Cabinet and the approved decisions constitute a white paper which is then sent to the legal drafters employed by the Law Officers Department within the Office of the Attorney General and Ministry of Justice. The drafted legislation is then submitted to Parliament in the form of an act/bill for debating and adoption; the adopted act/bill, however, only becomes law when it receives Presidential accent/signature.

#### 2.2.1.2 National environmental policy

The beneficial effects of chemicals to life can hardly be overstated. Without chemicals – in the form of food supplements, food preservatives, medicines, fertilisers, pesticides, cleaning agents, refrigerants, fire-resisting agents, cosmetics, etc. – life, as we know it today, would be impossible. However, there is also an unpleasant/harmful aspect to the use of chemicals. These unpleasant/harmful effects are frequently expressed as obnoxious health and environmental impacts, such as the increasing frequency of hitherto rare diseases like cancers, queer neurological and birth disorders, loss of biodiversity of certain types of fauna and flora, etc. It is against this background that Sierra Leone recognises the need for a strategic approach to the management of the use of chemicals, such that the beneficial effects far outweigh the inimical effects. The group of chemicals that are most relevant here are those referred to as “Persistent Organic Pollutants” (POPs). POPs share the following unique characteristics: persistence, toxicity, bio-accumulation, and the potential for long-range transport. Because of these unique properties (especially the fact that their unpleasant/deleterious effects can be expressed thousands of miles away from their places of production or use) coordinated global action is being employed to ensure that the continued production and use of POPs is banned.

As a responsible member of the global community, Sierra Leone is alive to the need for global action in the protection of the environment and of human health. This awareness is manifested by the fact that Sierra Leone, during its relatively short contemporary period of its stable democracy, is signatory and party to a number of international environment and health-related conventions/protocols (refer to Table 4 for a more comprehensive list).

In 1990, the Government with the support of the World Bank prepared three national documents on the protection and management of the environment and natural resources, namely the National Environmental Policy (NEP), National Environmental Action Plan (NEAP) and the National Environment Protection Act, 2000 (NEPA).

The National Environmental Policy (NEP), which was approved by the Cabinet in 1990 and revised in 1994 (GOSL, 1994), aimed at achieving sustainable development in Sierra Leone through sound environmental and natural resources management.. The policy objectives are to:

- Secure for all Sierra Leoneans a quality of environment adequate for their health and well-being;



- Conserve and use the environment and natural resources for the benefit of the present and future generations;
- Restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere;
- Preserve biological diversity, and uphold the principle of optimum sustainable yield in the use of living natural resources and ecosystems;
- Raise public awareness and promote understanding of the essential linkages between the environment and development and encourage individual and community participation in environmental improvement efforts.

The NEP also contains sector policies on land tenure, land use and soil conservation; forests and wildlife; biological diversity and cultural heritage; mining and mineral resources; air quality and noise; sanitation and waste management; toxic and hazardous substances; coastal and marine resources; working environment; energy production and use; settlements, recreational space and greenbelts and public participation. One of the major strategies which the Government is now pursuing to achieve the goals of the NEP is to make environmental impact assessment (EIA) of proposed activities, which may significantly affect the environment and the use of resources, a priority (GOSL, 1994).

The NEP also has a specific goal and policy for water resource management which ensures adequate quantity and acceptable water quality to meet domestic, industrial, transportation, agricultural and fisheries' needs by accelerating programmes for the utilisation of water for the various uses and expanding water quality management, monitoring and assessment programmes. Although laws prohibiting pollution of water bodies exist, they are hardly enforced.

### ***2.2.1.3 Agriculture and food security sector policy***

The Ministry of Agriculture and Food Security, in its drive to achieve Food Security by the year 2007, has prepared a policy intent document. This ministry deals with the protection of crops and animal diseases and therefore imports a lot of agrochemicals and likely POPs. This policy intent states thus:

#### *(a) Fertilisers and agrochemicals*

Intensified crop production normally requires the use of substantial quantities of fertilisers in order to exploit the potential of improved crop varieties, and to sustain the momentum of growth in production. There will also be a commensurate increase in requirement for agrochemicals such as pesticides, soil conditioners, etc. The government strategy entails the following:

- Encouraging the sustainable use of appropriate fertilisers and agrochemicals by farmers. To this end, the extension services will train and encourage farmers in the principles of integrated nutrient and pest management technologies;
- Transferring the responsibility for the procurement and distribution of fertilisers and agrochemicals to certified dealers in the private sector. The Government will, however, continue to monitor the sector in order to ensure that adequate quality, safety standards and fair prices are maintained;
- Encouraging the participation of entrepreneurs in the importation, marketing and distribution of fertilisers. Towards this end, the Government will waive duty for fertiliser importation, ensure that the road infrastructure is well maintained, and the entrepreneurs have credit guarantees to facilitate fertiliser imports and the purchase of delivery trucks;



- Since no private sector trade will develop if it has to compete with subsidised public importation and distribution, the Government will cease to subsidise the importation and distribution of fertilisers and agrochemicals.

#### *(b) Crop protection*

The objective of crop protection policy are to control and maintain surveillance of the major weeds, pests and plant diseases the incidence of which may cause large scale damage/loss to crop production.

To realise these policy objectives, the Government will:

- Establish and maintain an early warning system that constantly monitors national crop pests, diseases and weeds and draws attention to emerging threats;
- Put in place a mechanism for emergency control measures for epidemics;
- Put in place effective quarantine facilities at strategic border crossing points;
- Mount educational programmes that will make farmers appreciate the need for early warning of pest and disease outbreaks and encourage them to adopt appropriate control measures;
- Assist farmers in identifying pest problems and assessing crop losses;
- Encourage research institutions to carry out investigations on the biology and ecology of pests in any geographical zone and determine the most appropriate methods of control;
- Seek the assistance or cooperation of neighbouring countries with the objective of controlling pests and diseases of economic importance without endangering national security.

### **2.2.2 Roles and responsibilities of ministries, agencies and other governmental institutions**

#### **2.2.2.1 Profile of the Government**

Sierra Leone is a former British colony that is governed by a western style democracy that reflects largely the United States of America's system with a small blend of the British system. The constitution provides for 3 separate and independent organs of government, namely the Executive, the Parliament, and the Judiciary. Devolution of executive and parliamentary powers to the Local Government Councils on the basis of the Local Government Act 2004 is currently on-going. The aim is to give more power to the people at the grassroots level and enable them to competently participate in the planning and implementation of development programmes within their areas of jurisdiction.

##### *(a) The Executive*

The Executive is headed by the President who is elected by popular vote every 5 years. The President is assisted by the Vice President (also elected as running mate) and a group of ministers; these together constitute the Cabinet. The Cabinet Ministers are nominated by the President but must be vetted and approved by Parliament before they can serve in office.

##### *(b) The Parliament*

The Parliament is constituted of elected representatives of the various constituencies including Paramount Chiefs representing each of the 13 Districts and is the sole legislative organ; it is presided over by the Speaker and assisted by a Deputy Speaker both of whom are elected by Parliamentarians. In addition to the Plenary where bills are debated and laws enacted, Parliamentary Sub-Committees serve as oversight bodies for various ministries.



### *(c) The Judiciary*

The judiciary is headed by the Chief Justice who is appointed by the President on the advice of the Attorney General who also doubles as Minister of Justice. The judiciary operates along the British system and consists of the following organs: the Supreme Court, the Court of Appeal, the High Court, and the Magistrate Courts. The judges and magistrates that preside over the various courts are appointed by the President on the advice of the Chief Justice and are vetted by the Parliament before they are qualified to serve. The Sierra Leone Law Reform Commission, an independent body of prominent Sierra Leoneans appointed by the President, is responsible for the review of the country's laws.

#### **2.2.2.2 Government institutions involved with environmental management**

For a long time the administration of environmental issues in Sierra Leone was handled by a small department, the Environment Department (ED), appended to one of the major government ministries. The ED started as a unit in 1996 within the Ministry of Transport, Communication and the Environment; it was then transferred to and became a division within the Ministry of Agriculture, Forestry and the Environment in 1997 just before the interregnum. It was again transferred to the Ministry of Lands, Housing, Country Planning and the Environment (MLHCPE) in 1999 where on enactment of the Environment Protection Act 2000 it became a Department and is currently still based in this Ministry. The Department is headed by a Director of the Environment with a Board (the National Environment Protection Board – NEPB) that provides policy oversight. In 2006 a presidential pronouncement/fiat led to the creation of the National Commission for the Environment and Forestry (NaCEF); the goal is to blend the Environment and Forestry Departments into a Commission to be supervised by the President's Office to give these two issues greater focus and emphasis. The proposed administrative and professional structures for NaCEF are still evolving; the ultimate structure was expected to crystallise after the presidential and parliamentary elections in August 2007, but this has not yet happened as of now.

#### ***National institutional arrangements***

Numerous institutions in Sierra Leone are involved in the use of chemicals directly or indirectly in their daily operations; however, there are no specific institutional arrangements and legislative framework for the use and management of chemicals. Nonetheless, these institutions have practices, policies and regulations with regard to the utilisation of chemicals and/or to natural resources management.

#### ***National Commission on Environment and Forestry (NaCEF)***

This commission (which is still going through administrative and legislative metamorphosis) is intended to be the main authority for the management of the environment and forest resources in Sierra Leone. It is intended to carry out its mandate through two departments, namely the Environment Department and the Forestry Department. The Environment Department of the Commission is the lead agency for the implementation of the Stockholm Convention and the three Rio Conventions, i.e. the United Nations Conventions on Biological Diversity (UNCBD), the United Nations Framework Convention on Climate Change (UNFCCC), and the United Nations Convention on Combating Desertification and/or Land Degradation (UNCCD). The Department acts as the focal point for all national and international environmental issues relating to Sierra Leone and has the responsibility to coordinate and monitor the implementation of all environmental policies, programmes, projects and activities. It is empowered under the EPA to put in place all necessary mechanisms and environmental standards and legislation to protect and manage the environment and its natural resources.



It is proposed that the Commission be represented on the boards and committees of government line ministries and related institutions in order to promote effective collaboration and cooperation for proper environmental and natural resources management and thereby to ensure the mainstreaming of environmental sensitivity in natural resources management. It is also proposed that the Commission will have a board that will take over the functions of both the National Environmental Protection Board and the Forestry Board by providing policy and professional oversight (such as the review of Environmental Impact Assessments – EIA) and facilitating coordination, cooperation and collaboration among government ministries, local authorities and other government agencies in all matters relating to environmental protection and management.

The mandate of the Forestry Department is intended to be the collection of baseline data on forest reserves and forest biodiversity, monitoring and protection of improved forest trees, establishing a mechanism for harvesting and replenishing of forest resources on a sustainable yield basis, protecting watersheds, and developing wildlife sanctuaries, promoting agro-forestry and community woodlots, promoting afforestation/reforestation and put in place measures that ensure the control of erosion and bushfires. The Wildlife Conservation Branch, which is under the Forestry Division and supervised by the Director of Forestry, has the mandate to manage all of the nation's protected areas and implement the provisions of the Wildlife Conservation Act and enforce the laws contained therein.

#### *Ministry of Agriculture and Food Security (MAFS)*

The mandate of the ministry spreads across crop and domesticated animals development and improvement policies, and related services. The ministry exercises mandate over the environment through such Departments as Agriculture, Land and Water Development, Planning, Evaluation, Monitoring and Statistics and the Livestock Unit.

#### *The Ministry of Mineral Resources (MMR)*

This ministry controls all mining activities in the country. In recognition of the negative impact of mining on the environment and concerns expressed by the public, the Ministry has developed a new mining policy and legislation, which make provision for the rehabilitation of mined out areas and ensure “that prospecting, exploration, mining and processing of mineral resources proceed in an environmentally sound manner”. The mining code stipulates that large and medium scale mines develop and submit an Environmental Impact Assessment (EIA) prior to the application for a mining license. The EIA must clearly state the appropriate steps/actions to be taken to mitigate damage caused by mining activities on the environment. The ministry contributes to the management of natural resources through provision of grants to local communities for the rehabilitation of mined out areas.

#### *The Ministry of Fisheries and Marine Resources (MFMR)*

This ministry manages, develops and conserves all fisheries and marine resources. The Fisheries Management and Development Act of 1988 (GOSL, 1988) and the Fisheries Regulation of 1990 prescribe the preparation of management and development plan, specific procedures for licenses, and measures for conservation, enforcement and surveillance.

The management of marine and coastal resources is shared between the Ministry of Fisheries and Marine Resources, the Institute of Marine Biology and Oceanography (IMBO) of the University of Sierra Leone at Fourah Bay College, and the Maritime Authority of Sierra Leone and Maritime Protection Services of Sierra Leone (MPSSL). The performance of these institutions is very low due to the very low conviction rate of vessels charged with violating regulations and fixed fines at levels that make them ineffective as a deterrent (MPSSL, 1992).



### *The Ministry of Energy and Power (MEP)*

The Water Supply Division (WSD) in the ministry, the Guma Valley Water Company and the Sierra Leone Water Company (SALWACO) have the responsibility to provide and conserve water and to control the water quality. The Department of Energy and Power (DEP) is responsible for the national energy policy, the development of energy resources and the promotion of energy conservation.

### *Ministry of Labour and Industrial Relations (MLIR)*

The Factory Inspectorate of the Ministry of Labour and Industrial Relations is the unit charged with ensuring health and safety at the workplace. In the execution of its mandate the Factory Inspectorate deals with matters related to the management of the use of chemicals including POPs. Through its membership of the International Labour Organisation (ILO) this unit is a party to a number of ILO conventions/protocols related to the management of chemicals. The Convention on Occupational Health and Safety at Work is perhaps the most relevant here.

### *Ministry of Tourism and Cultural Affairs (MTCA)*

The MTCA supervises the National Tourist Board and the National Museum on tourist promotion and development. It also liaises with relevant ministries/departments regarding the preservation of ancient monuments and relics and environmental protection for tourism and eco-tourism.

## **2.2.3 Institutional infrastructure for importation of chemicals**

### *Customs and Excise Department (CED) of the National Revenue Authority (NRA)*

At present no economically useful chemical is manufactured in Sierra Leone; these chemicals therefore have to be imported. The Customs and Excise Department (CED) of the National Revenue Authority (NRA) is the government organ responsible for overseeing and regulating the importation of chemicals into Sierra Leone. This department faces a number of challenges in the achievement of its ultimate goal of mobilising revenue for development. Some of these challenges include the employment of the right mix of personnel (including those with the requisite scientific background to support the chemical management efforts demanded by the Stockholm and other related Conventions) and requisite modern equipment and technology. The existence of a small number of customs posts, each covering hundreds of kilometers of porous borders connected by poor road and telephone network, is an added challenge.

### *Ministry of Trade and Industry*

One of the major assignments of the Ministry of Trade and Industry is the management of standards and quality in Sierra Leone. This ministry achieves its goal by supervising the Sierra Leone Standards Bureau (SLSB) which is an autonomous coordinating body responsible for all standards and quality issues in the country. The general mandate of the bureau is to ensure the safety of products consumed in Sierra Leone. The SLSB develops and adopts standards, is responsible for the inspection of goods and provides testing and quality control services. The bureau is currently financed from three sources: subventions from central government, a 0.03% levy on all imports and exports, and funds from international donors. The levy on imports and exports is fixed at a given level for all transactions. It is expected that as this bureau develops, this levy should be replaced by a fee directly related to the services provided.

Sierra Leone is a member of the World Trade Organisation (WTO) and needs to take further steps to meet the requirements of the Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary



(SPS) Agreement by making its technical regulations transparent to trading partners. The SLBS has been nominated as the enquiry point for both SPS and TBT issues. An effective notification and enquiry point requires trained staff and the resources to undertake inter-agency and inter-ministerial contacts and coordination and to manage the necessary flow of information.

Analytical laboratory capacity in Sierra Leone is extremely weak. The SLSB does not have its own laboratory and currently uses the services of laboratories in universities, hospitals and in the private sector. Thus an important issue is how to build capacity in testing services so as to achieve the dual goal of protecting domestic consumers and of facilitating access to overseas markets for exports. The SLSB wishes to develop testing capacities on its own premises but this is a long term goal that requires a high level of capacity building in terms of personnel and equipment. Other options that are being investigated include the University of Sierra Leone, which has some minimal physical and human infrastructure that would require relatively limited upgrading but which is completely devoid of equipment. An advantage of developing capacity at the university is that the facilities could also be used to improve teaching through practical laboratory experience (which is currently not available to students). An increase in the number of scientists with practical experience would be of relevance in the longer term to firms that wish to develop their own testing capacities and to private laboratories that may emerge as the economy develops and diversifies.

## **2.2.4 Roles of private sector, academic and other non-governmental institutions**

### **2.2.4.1 Local and private sector institutional arrangements**

Sierra Leone, which has just emerged from a decade-long civil conflict, cannot immediately initiate an assessment of natural resources management. This may be due to the poor resources available to government agencies and the pernicious degradation of the environment by rural communities.

However, the Government, NGOs and local communities have over the years initiated activities that are providing the nature of natural resources management interventions. Problems that are identified have been under scrutiny in these initiatives, including the poor level of resources available to the different sectors.

Various personalities and village level organisations throughout the country have a direct impact on the use and management of natural resources. The relative importance and effectiveness of these individuals/bodies vary greatly between one natural resource and the other. They are, however, all concerned with some aspect of natural resources management.

Individuals/organisations found in most villages and towns that are of direct relevance to the use of forest resources include:

- Traditional authorities, i.e. the chiefs and elders
- Village development committees (which provide linkages between traditional authorities)
- Producer associations, farmers' associations, etc.
- Market women's associations
- Mutual support groups for farming activities
- Fire volunteer squads

While some villages are headed by a "headman" with little land resource holding responsibilities, there are other chiefs with vast land resource holding responsibilities. The importance of these authorities in natural resource issues vary widely, but generally the village or town chiefs play key



roles in natural resources management. Chiefs have the responsibility to ensure that concession holders and developers in mining, timber production, palm wine production, sand extraction, etc. pay royalties. There is, however, little evidence that these chiefs carry out actions to ensure the conservation of the resources.

Village development committees operate in response to directives from the Government, NGOs and Community Based Organisations (CBOs). They generally organise communal labour initiatives often with plans for the management of natural resources. Farmers associations are widespread and assume responsibilities for a wide range of farming activities.

Fire volunteer squads are formed and operate in many communities. In the dry season, fire is the dominant causal factor in the changing use of land. As a result, fire is one of the issues that stimulate the highest degree of consensus and opinion.

The new dispensation to decentralise planning and administration to a local level will reinforce the local government council's role in:

- Ensuring the enforcement of bushfire laws
- Initiating tree planting campaigns
- Prompting payment of royalties and surface rents to land owners whose lands are mined out
- Regulating chainsaw operators
- Prohibiting clearing and cultivation of riversides
- Prohibiting planting on marginal areas

Formidable women organisations that have links with natural resources management also exist since they access a variety of forest products. They see the need for controlled harvesting of resources and have the ability to enforce rules about who could harvest how much and when.

#### **2.2.4.2 Non-governmental organisations (NGOs)**

Non-governmental organisations (NGO's) in Sierra Leone have supported communities to address sustainable use of natural resources. They have done this through encouraging communities to maintain forest reserve areas, promoting community biodiversity, supporting livestock production and management and park management.

There is a strong NGO sector in Sierra Leone creating public interest in environmental issues. The most active NGOs on the ground in areas related to environmental and natural resources management are:

- The Conservation Society of Sierra Leone (CCSL), which promotes the conservation and sustainable use of Sierra Leone's natural resources through research, education, advocacy and support to site management groups. CCSL also undertakes campaigns for the protection of wildlife, parks and sanctuaries.
- The Environmental Foundation for Africa (EFA), whose mission in Sierra Leone is to restore and protect the environment and its natural resources. It has acquired experience in terms of operation in conflict zones, humanitarian and refugee operations, post-conflict reconstruction and rehabilitation.





- The Commonwealth Human Ecology Council (CHEC-SIL) promotes conservation of the ecology through education and disseminates environmental information through the mass media. It also supports the Government of Sierra Leone (GOSL) in promoting, through education, policy implementation and project execution.
- The Organisation for Research and Extension of Intermediate Technology (OREINT) promotes self-sustaining rural development through the promotion of agriculture and appropriate technology to enhance and improve the socio-economic status of the people in rural areas.
- Green Scenery and Friends of the Earth are other local NGOs that are actively involved in tree planting and awareness-raising campaigns on the protection and management of the environment and natural resources.

#### **2.2.4.3 Academic institutions**

The Njala University, which evolved from the University of Sierra Leone in 2004, has a Faculty of Environmental Sciences with four academic departments that focus on teaching and research activities on the environment. Numerous other institutions within the present University of Sierra Leone are involved in environmental and natural resources data gathering, monitoring, and evaluation. These include the Departments of Biological Sciences and of Chemistry, the Institute of Marine Biology and Oceanography (IMBO), the Institute for Population Studies (IPS) (all at Fourah Bay College) and the Division of Community Health at the College of Medicine and Allied Health Sciences.

#### **2.2.5 Relevant international commitments and obligations**

Sierra Leone is a signatory to a number of international treaties and agreements relating to the management of the use of chemicals including Persistent Organic Pollutants (POPs). In a bid to foster international collaboration and cooperation in sound environmental management, the country signed and ratified a series of sub-regional, regional and global environmental conventions. Some of these treaties and conventions could be directly or indirectly related to chemicals or POPs management.

##### *Stockholm Convention on Persistent Organic Pollutants*

The Convention was adopted and opened for signature at a conference of plenipotentiaries held from 22 - 23 May 2001 in Stockholm, Sweden. Sierra Leone signed and acceded to the Stockholm Convention on Persistent Organic Pollutants (POPs) on 26th September 2003. Being a signatory to this convention, Sierra Leone is obliged to prepare her National Implementation Plan (NIP) to reduce or eliminate the use of POPs by 2025.

Persistent Organic Pollutants possess toxic properties, resist degradation, lead to bioaccumulation and 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. They are of health concerns, particularly their impact on women and future generations. Thus, their production and use as pesticides and as dielectric in transformers and capacitors needs to be eliminated and the generation of unintentionally produced POPs ought to be reduced.



*Bamako Convention on the Ban of the Importation into Africa and the Control of Transboundary Movement of Hazardous Waste within Africa*

The goal of this Convention is:

- 1) To protect, by strict control, the human health of the African population against adverse effects which may result from hazardous wastes by reducing their generation to a minimum in terms of quantity and/or hazardous potential;
- 2) To adopt precautionary measures to ensure proper disposal of hazardous wastes and to prevent dumping of hazardous wastes in Africa.

Sierra Leone adopted this Convention in 1991 and ratified it in 1993.

*Rotterdam Convention*

Sierra Leone is yet to become a signatory to the Rotterdam Convention on Prior Informed Consent (PIC) for certain hazardous chemicals and pesticides in international trade. However, efforts are ongoing to sign and ratify this convention.

*Basel Convention*

Sierra Leone is not a signatory to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. However, efforts are underway to sign this convention.

The most plausible explanation as to why Sierra Leone is not yet a member of the Rotterdam and Basel Conventions (considered to be forerunners/precursors to the Stockholm Convention) is the now ended 11-years long civil war which did not permit the normal administrative machinery to function to the extent of signing an international convention.

*Convention for the Prohibition of Chemical Weapons*

Sierra Leone signed this Convention on 15 March 1993.

*International Plant Protection Convention (IPPC)*

Sierra Leone became a party to the International Plant Protection Convention on 23 June 1981. This convention obliges the Government of Sierra Leone to protect plants that are within and those entering the country especially the invasion of alien species.

*United Nations Convention on the Law of the Sea (UNCLOS)*

Sierra Leone became a signatory to the United Nations Convention on the Law of the Sea (UNCLOS) on 12 January 1995. Under this convention, Sierra Leone is obliged to protect the sea from pollution from land and sea-based activities.

*Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention)*

Sierra Leone signed the Abidjan Convention on 7 June 2005. The Abidjan Convention is a comprehensive umbrella agreement for the protection and management of the marine and coastal areas. It lists the sources of pollution which require control; pollution from ships, dumping, land-based sources, exploration and exploitation of the seabed, and pollution from or through the



atmosphere. It also identifies environmental management issues for which cooperative efforts are to be made; coastal erosion, especially protected areas and combating pollution in case of emergencies.

*United Nations Convention on Biological Diversity (UNCBD)*

In 1994, Sierra Leone became signatory to the UNCBD and in 1996, GOSL ratified the CBD. In response to its obligations under the UNCBD, the then Ministry of Agriculture, Forestry and Marine Resources, Ministry of Lands, Country Planning and the Environment, with support provided by the United Nations Development Programme (UNDP), formulated the Biodiversity Strategy and Action Plan (BSAP) in 2003 and submitted its first draft report to the Conference of Parties (COP). This process was interrupted by the period of political instability, but restarted in 2000 - 2001. This formed the basis for the implementation of biodiversity country studies.

*United Nations Convention on Combating Desertification (UNCCD)*

GOSL signed and ratified the UNCCD on September 25, 1997. Since then, an elaboration of the National Action Plan (NAP) for the implementation of the CCD within the context of Sierra Leone's economic, social and environmental conditions has been undertaken. The then Ministry of Lands, Country Planning and the Environment was designated the lead agency for the implementation of UNCCD. The national focal point is within the Environment Protection Division (EPD) in the National Commission on Environment and Forestry. In 2002, the National Steering Committee for Desertification submitted Sierra Leone's first national report on the implementation of the CCD to the UNCCD Conference of Parties.

*United Nations Framework Convention on Climate Change (UNFCCC)*

Sierra Leone signed, ratified, and became a party to the UNFCCC, on June 25, 1995. With support from GEF Sierra Leone has undertaken a country study on the Initial National Communication (INC) for the UNFCCC and has submitted it to the COP, in compliance with the provisions outlined under Articles 4 and 12 of the Convention's guiding principles, namely:

- Considerations as a Non-Annex 1 developing country party with special circumstances;
- The extent of its capabilities;
- Regards for the common but yet differentiated responsibilities; and
- Partnership and sustainable development.

The country is in the process of developing the National Adaptation Plan of Action (NAPA). When completed, the policies and plans emanating from this document would be mainstreamed into the country's development programmes.



**Table 4: Status of international conventions/protocols related to management of chemicals**

Convention/Protocol	Signed	Ratified
The Stockholm Convention on Persistent Organic Pollutants		Acceded 26 September 2003
The Montreal Protocol of the Vienna Convention on Protecting the Ozone Layer	21 August 2001	21 August
The United Nations Convention on Biological Diversity (UNCBD)	1994?	1996?
The United Nations Convention on Combating Desertification (UNCCD)	25 September 1995	25 September 1995
The United Nations Framework Convention on Climate Change (UNFCCC)	22 June 1995	22 June 1995
Convention on the Prohibition of Chemical Weapons		
The Bamako Convention	Not yet signed	Not yet ratified
Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (The Abidjan Convention)	7 June 2005	7 June 2005
The Basel Convention	Not yet signed	Not yet ratified
The Rotterdam Convention	Not yet signed	Not yet ratified
International Plant Protection Convention (IPPC)	23 June 1981	23 June 1981
United Nations Convention on the Law of the Sea (UNCLOS)	12 January 1995	12 January 1995

## 2.2.6 Description of existing legislation and regulations addressing POPs

### 2.2.6.1 *The Environment Protection Act 2000*

The Environment Protection Act (EPA) of 2000, which was enacted into law on 28 February 2000 established the Environment Protection Department (EPD) and authorised the Director of EPD and Minister of the Environment to administer and monitor the implementation of the act. The act makes provision for Environmental Impact Assessment (EIA) for certain types of projects to be undertaken within Sierra Leone, which include agriculture, mining, construction, waste disposal, and exploitation of hydraulic resources. In compliance with the Environment Protection Act, the EIA document to be submitted by the “Developer” must clearly give information on the project, its possible impacts on the ecosystem and its locality; social, economic, and cultural effects that the project is likely to have on the people and society; information on how the consultative process with the communities, interested parties, and government ministries is to be carried out; actions or measures taken or to be taken to avoid, prevent, change, mitigate, or remedy the likely effects on the natural resources, people and society of the project area; plans for decommissioning the project; and other information for proper review of the potential environmental impact of the project should also be provided in the EIA document.

Once submitted, the Director will solicit comments on the EIA report from professional associations, governmental ministries, non-governmental organisation (NGOs) and the public. Following a two-week public comment period, the Director will submit the EIA document and the comments to the National Environment Protection Board (NEPB). The Board may provide recommendations to further assess the likely environmental impacts, and/or disapprove the EIA in cases where the proposed alternatives are expected to have significant adverse effects on the environment or natural resources, individuals, or society.



Upon approval of the EIA document, a license is issued for a twelve-month period or a time specified by the Director of Environment. Once the license is issued, the Director is to undertake effective monitoring of the project's activities and its environmental impacts to verify compliance. The Minister of Environment may prescribe fees for the license if the terms and conditions of the license are not in compliance with the Environment Protection Act or if there is a substantial change in the project's operations resulting in an adverse effect on the environment. At the expiration of this period, the Director has the authority to renew or revoke the license.

In issuing a license for a project based on an EIA, the Minister also has the authority to establish regulations for national environmental standards pertaining to the use of natural resources, water quality, effluent limitation, air quality, wastes, atmospheric and ozone protection, noise control, pesticide residues, and odours. Internationally banned chemicals are prohibited in Sierra Leone, as well as the discharge of any hazardous substances into air, land, and water.

The management of the use of chemicals is a cross-sectoral endeavour. The Environment Department of NaCEF is charged with the responsibility to coordinate the activities of related sectors/ministries with a view to achieve synergies in the overall effort to protect health and the environment.

#### **2.2.6.2 *The Mines and Minerals Act, 1994***

The Mines and Minerals Act of 1994, which came into operation on 4 March 1994, addresses mining leases and licenses requirements for artisanal and industrial mining. When a proponent/miner applies for a mining lease, he has to provide information on the period of time for which the lease is sought; estimated mineral deposits, reserves, and mining conditions; mining treatment options and those selected for use in the mining project; specific details of the mining operation such as the schedule, nature of production, potential environmental and social impacts, forecast of capital investment, operating costs and revenues, and the anticipated source of financing, proposed mitigation programs and marketing arrangements for the sale of the mineral production should be provided and forwarded to the Director of Mines in the Ministry of Mines and Mineral Resources.

Other requirements under the Mines and Minerals Act include the prohibition of illegal exploitation and disposal of any radioactive minerals.

#### **2.2.6.3 *The New Forestry Act (NFA), 1988***

The Act contains special protection provisions under which the Minister is empowered to declare any area to be a "protected area for the purpose of conservation of soil, water, flora and fauna". The legislation stipulates that no person may cut, burn, uproot or destroy trees that are in protected areas (PAs) or trees that have been declared as being protected. The section of the law states that any forest officer designated by the Chief Conservator/Director of Forest may issue a license authorising the holder to fell and extract a protected tree. The Wildlife Conservation Clause under this Act empowers the Minister to declare an area as a strict Nature Reserve, Natural Park or Game Park. In such areas, activities specified in the act are prohibited "unless duly authorised".

#### **2.2.6.4 *Draft National Policy and Land Commission Act (NPLCA), 2004***

Currently, a comprehensive Land Policy and Lands Commissions Act is being formulated by the Ministry of Lands, Country Planning and the Environment. The draft land policy document is intended to serve as a useful guide for the smooth administration and management of land. The policy provides the framework to ensure equity in access to land and to provide security to tenure in order to maintain a stable environment of the country's sustainable, socio-economic development.



The Land Commission Act is to establish a Commission with its composition and functions and for other purposes including the management of state lands, the execution of a comprehensive programme for the registration of title to land throughout Sierra Leone.

### ***Shortcomings***

In spite of this seemingly impressive array of environmental and related laws, the legislation has not fully provided a platform for the sustainable use of the country's natural resources and proper management of the environment. This can be attributed to the following reasons:

- Lack of implementation, enforcement and compliance;
- Potential conflicts of interest within sectors by not linking environmental and natural resources management responsibility with other development interests;
- The relative absence of an autonomous Environmental Protection Agency vested with both advisory and executive authority at all levels of government to design, monitor and implement environmental policies;
- Lack of an accepted and effective mechanism that ensures the coordination of environmental and natural resources management issues in the sectoral ministries and line agencies and also provides information to the main Environment Department to carry out effective monitoring of the implementation of environmental policies.

## **2.2.7 Key approaches and requirements for POPs chemicals and pesticides management**

### ***2.2.7.1 Current approaches***

As contracting party to the United Nations Convention on Biological Diversity (UNCBD) in 1994, the Government of Sierra Leone through the then Ministry of Agriculture, Forestry and Food Security (MAFFS) in collaboration with the then Ministry of Lands, Country Planning and the Environment (MLCPE) with assistance from the Global Environment Facility (GEF) developed the Biodiversity Strategy and Action Plan (BSAP) and Country Report to the CBD Conference of Parties (COP) which assessed the threats to the nation's biodiversity and of the sustainability of the use of biological resources in Sierra Leone.

Currently, the implementation of the project document entitled "Enabling Sierra Leone's capacity to fulfil its obligation to the United Nations Framework Convention on Climate Change (UNFCCC)" is completed. The country is waiting to receive funding to start the second communication process to the Conference of Parties (COPs). Secondly, the National Adaptation Programme of Action (NAPA) is underway at the meteorological department.

With financial support from GEF, Sierra Leone has completed the National Capacity Self Assessment (NCSA) Needs Project for the implementations of the three Rio Conventions (UNCBD, UNCCD, and UNFCCC). This project was executed by the Environment Department.

The country has also prepared a National Biosafety Framework (NBF) under the Cartagena Protocol on Biosafety.

Sierra Leone is a Signatory of the Montreal Protocol of the Vienna Convention on the Protection of the Ozone Layer and is currently implementing a National Phase-Out Plan for Ozone Depleting Substances (ODSs). The relevant legislation leading to ratification is at the drafting stage.



### 2.2.7.2 Initial observations on capacity gaps

As can be seen from Table 4, Sierra Leone is still to ratify several conventions/protocols related to chemicals management or to management of the environment in general. This rather unsatisfactory situation can be ascribed to a number of factors, key among which are the following:

I. A number of democratic institutions, including the Parliament and the Judiciary, either collapsed or were non-functional during the 11 years long civil war.

II. The brain drain that arose from a lousy political regime with its attendant austere economical conditions prior to the war became accelerated during the war. The result was a mass migration of well trained and skilled professionals and intellectuals leading to a serious human capacity crisis that has now become acute. Presently there are so few legal drafters in the government service that a huge backlog of legislation – including some related to chemicals management – is awaiting drafting. This situation is naturally aggravated by the very poor salaries that are paid to government employees. This unsatisfactory state of affairs also applies to personnel that work in analytical chemistry laboratories and in other areas crucial to the management of chemicals; Table 5: Personnel and material capacities gives an indication of capacity gaps.

**Table 5: Personnel and material capacities**

Institution	Personnel		Equipment	
	Present relevant capacity	Ideal relevant capacity	Present relevant capacity	Ideal relevant capacity
Chemistry Laboratory at Fourah Bay College, USL	4 Ph.Ds 0 M.ScS 4 B.Sc.Hons. (Chem.) 4 Lab. Technicians	20 training for analytical chemists and laboratory technicians required	very low No GC, FTIR, UV-VIS, AAS,ICP	high GC or GC-MS FTIR, UV-VIS, AAS,ICP needed
Chemistry Lab at Njala University	10	20	low	high
Analytical Lab at the Pharmacy Board	2	10	low	high
Laboratory at the Sierra Leone Standards Bureau	1	10	low	high
Crop Protection Unit	25	50	nil	high
Fertiliser Unit	3	10	low	high
Law Officers Department	14	50	low	high
Customs and Excise Dept	19	30	low	high
Sierra Rutile Ltd	13	30	moderate	high

III. Another constraint to chemicals management is the lack of equipment needed for the analysis and identification of sites contaminated by POPs (and other prohibited chemicals). The war years caused that even the few working instruments became derelict/dysfunctional due to lack of maintenance (as large numbers of technicians fled the country) and spare parts. Most of the laboratories, especially at the universities, are only now slowly being reequipped.

IV. The rather technical nature of most conventions/protocols related to chemical management



coupled with the somewhat low capacity of most parliamentarians to connect with the underlying issues.

V. The targeted physical destruction of government buildings and facilities by the rebels during the war resulted in the loss of several draft legislations, thereby hampering the subsequent enactment of the laws. The following are reported to have been lost in just the Crop Protection Unit of the Ministry of Agriculture and Food security:

- Pesticide Act, 1989
- Plant Quarantine Regulations of Sierra Leone, 1989
- Plant Quarantine Proposals, 1989

Other crucial areas of capacity gaps include the management of the importation of chemicals. It is to be noted that the vast majority of the personnel of the Customs and Exercise Department lack the requisite scientific background for a significant contribution to national efforts in chemicals management; the senior management consist mostly of graduates of the humanities with a small minority being graduates of economics; there is also a significant number of non-graduates with no scientific background. This scenario presents a serious capacity gap that must be addressed.

#### ***2.2.7.3 Requirements for improving chemicals and specifically POPs management***

It should be clear from the foregoing that the capacity of Sierra Leone to successfully execute the National Implementation Plan for the elimination of POPs is presently very weak. The key institutional structures (especially the National Commission for Environment and Forestry – NaCEF) are still evolving and with the advent of a new political dispensation dramatic developments may be in the offing; the state of the requisite physical infrastructure (analytical chemistry laboratories and equipment) is very fragile especially with respect to the absence of equipment; the human capacity is grossly inadequate and also very weak especially in terms of numbers of adequately trained analytical chemists, laboratory technicians and equipment maintenance technicians as well as legal drafters. The other area of capacity constraints is the lack of local resources to fund the NIP. The point must be underscored that this capacity weakness is very largely the result of the effects of the recently concluded civil war which dramatically accelerated the migration of trained personnel out of the country and also destroyed much of the country's infrastructure; the latter also severely compromised the Government's ability to mobilise resources to address environmental issues in the face of other competing more life threatening demands for scarce financial resources.

#### *Development of monitoring, research, and training capacity*

This process will entail the following activities:

- Acquisition, maintenance and servicing of analytical chemistry laboratory equipment
- Training of analytical chemists and technicians for the operation, maintenance and servicing of laboratory equipment relevant to the analyses and monitoring of POPs
- The development and/or adoption of cost effective analytical methodologies for POPs
- Acquisition of laboratory accreditation and establishment of sub-regional accreditation bodies under the ECOWAS and AU science, technology and development initiatives
- Utilisation of indigenous knowledge connected with non-chemical alternatives to POPs
- Development of training materials, modules, and curricula for schools and tertiary institutions





- Collaboration with regional and international centres involved with POPs issues (e.g., Basel and Rotterdam Convention centres)

#### *Development of legislative capacity*

The aim here will be to achieve the ratification of the outstanding related MEAs (Multilateral Environmental Agreements)

This process will entail the following activities:

- Training and retaining MEA-specific drafters; these are to put on special (higher) scales at the Law Officers Department or be given a fixed allowance/honorarium for each legislation drafted.
- Conduction of regular training programmes aimed at mainstreaming POPs and other environmental issues. This training must target journalists with interest in science and/or environmental issues, parliamentarians that are members of oversight committees on science, environment and health sectors, civil society groups with interest in environmental issues, Public Relation Officers of sectors relevant to POPs and the environment, relevant Ministry of Finance officers.

#### *Capacity building priorities*

- Monitoring, assessment and technical analyses of data on POPs
- Research into indigenous alternatives to POPs
- Awareness-raising and sensitisation among key stakeholders including decision makers at local and national levels
- Identifying and building on synergies with other chemical, waste and environmental conventions
- Domestication of the Stockholm Convention with national legal instruments
- Harmonisation of policies at sub-regional levels and enhancing regional inspection at points of entry

#### *Financial resource mobilisation*

Mobilisation of adequate financial resources at national and international levels is crucial to the timely and sustainable implementation of the Convention. The following are possible areas worth looking at:

- 1) Technical assistance provisions under the various MEAs to be carefully examined with a view to aggressively developing associated projects with benefits mutual to chemicals management
- 2) Promoting non-chemical alternatives to current uses of chemicals (e.g., pyrethrum production) at agricultural and industrial exhibitions
- 3) Adoption of environmentally sound technologies through the introduction of BAT/BET
- 4) Development of chemical management systems – to include a national chemicals profile, national emergency preparedness and response plans.



- 5) Technology access transfer and diffusion
- 6) Information dissemination

Targeted areas for research:

- 1) Determination of levels of POPs in the marine and fresh water environments and in fisheries – the aims here will be to overcome the TBT (Technical Barriers to Trade) impediment to marine exports and to protect the health of the local population
- 2) Reducing the POPs contamination by run-off of water bodies

## *2.3. Assessment of the POPs Issue in the Country*

### **2.3.1 Pesticides and DDT inventories**

#### ***Summary***

After the signing of the Stockholm Convention by Sierra Leone in 2003, it became obligatory to develop a plan for phasing out POPs pesticides including DDT or to apply for exemptions where permitted. As a result, a Task Team was formed to prepare inventories of pesticides including DDT. This process was then divided into phases.

Phase I was conducted in the Western Area, due to its commercial importance, while in Phase II all the provincial and rural areas within the provinces were visited to ascertain the presence and use of POPs pesticides and pesticides in general. Protective gears were used during the exercise for the safety of the task team members.

On-the-spot interviews were conducted and face to face discussions were held with personnel, workers, traders and farmers involved in the use and sale of pesticides.

In the past POPs pesticides were used across the country, such as DDT and dieldrin. However, these pesticides have been out of use since the late 1970s and 1980s. The only POPs pesticide still in use is HCB.

In the Western Area pesticides are used mainly for the control of domestic pests, whereas in the rural areas they are used predominantly for agricultural purposes.

Private contractors (e.g., Pesmagri and Cogo) are engaged in the importation and supply of pesticides to the line ministries, while importation and sale to the public sector is done by local businessmen and women. Unspecified quantities of these pesticides are also smuggled by these people into the country through neighbouring Guinea.

Some quantities of obsolete pesticides, e.g., Kocide 101 are still in stock, this perhaps may be due to lack of improper disposal methods. As there is lack of awareness about the dangers involved in the handling and use of pesticides, they have sometimes been used for the wrong purposes. For example, HCB is used in controlling ectoparasites, such as head lice, and in fishing. Thus, deaths have resulted in human and marine life. It was also observed that human and material capacity in the use of POPs pesticides and pesticides in general is inadequate.

Empty pesticide containers are being recycled and used for various domestic purposes. Based on these findings, laws governing the importation and use of pesticides must be put in place.



Disposal and use of pesticides should be done by competent authorities. Education, training and awareness programmes should be developed for the public sector and the key ministries involved in pesticide management. Different pesticides were discovered in use throughout the country, but of these only HCB belongs to the POPs pesticides.

### **2.3.1.1 Introduction**

After the rebel war, Sierra Leone experienced rural to urban migration of all categories of people that resulted to overpopulation in all the district headquarter towns. Due to this influx of migrants and scarcity of job opportunities, many of these migrants engaged themselves in various commercial activities. One such activity is the sale/spraying of chemicals against domestic pests (bed bugs, cockroaches, ants, etc.) The use of these chemicals is widespread and those using them do not actually know the effect either on them or on the environment. As a result of such practices, some unforeseen consequences arise that are given different interpretation by people because of their scanty knowledge of these chemicals. The districts headquarter towns, being the centres of most commercial activities, are the ideal locations for the sale and distribution of these pesticides to the rural communities. Because of the low income earnings by workers involved in the management of these chemicals, some of the chemicals are not used for their intended purpose.

### **2.3.1.2 Institutional and regulatory framework**

There are two existing institutions that are supposed to handle and monitor the distribution and use of pesticides and DDT in Sierra Leone. These are the Ministry of Health and Sanitation and the Ministry of Agriculture and Food Security. Under the Ministry of Health and Sanitation, the Entomology Department is the main division that handles pesticides, whilst in the Ministry of Agriculture and Food Security the Crop Protection Division is responsible. No existing regulatory mechanisms are in place on the importation/exportation, distribution and use of pesticides in Sierra Leone. Similarly, there is no regulation for banning and licensing of commercial rights for handling POPs pesticides.

### **2.3.1.3 Past, present and projected future production and use of POPs pesticides**

There are no indications of past and present production of POPs pesticides in the country. Such technology has not yet been developed. However, a projected future production cannot be ruled out based on the provision given for the exemption of countries by the Convention for the treatment of disease vectors.

In the past, POPs pesticides have been widely used in the control of various pests. For example, DDT was used to protect soldiers and civilians from mosquitoes. Dieldrin, HCB, phosphine, methyl bromide, bidrin, and lindane were used as soil fumigants in the production of tobacco in the provinces especially in the Bombali, Kambia, Tonkolili, Bo and Moyamba districts. Gammalin 20, cocotine, and bidrin were used for fishing in the past. HCB was and is still used in local fishing practices, preservation of kola nuts and treatment of head lice.

Aldrin and azodrin were used in the control of beetles in cashew nut production. Stam F-34, gammalin 20, gammazone, cocotine, tennate, and klerate were widely used in the past for the control of a variety of pests across the country. At present, malathion and furadan are used as broad spectrum pesticides.

According to information obtained in the Northern Province of the country, ash from rice husk is added to malathion to produce a substance which local farmers referred to as B.H.C. Kocide 101 was used as fungicide and bactericide in cocoa production. Permethrin is used as insect powder against a



wide range of insect pests. Endosulfan is also used in the control of insect pests. With the present drive of food security nationwide, there is the likelihood of an increased use of pesticides in the future, since it is viewed as a means to reduce pre and post harvest losses.

DDT was used in the control of insect vectors that cause malaria and onchocerciasis, especially along the Rokel River in the Tonkolili district, Scarcies River in the Kambia district and the Taia River in the Moyamba district. Presently DDT is not in use in the country. However, due to the prevalence of malaria, future use cannot be ruled out.

Future production of pesticides is not planned due to the capital, technology and expertise involved.

### 3.3.2. Importation and exportation of pesticides

The Ministry of Agriculture and Food Security and the Ministry of Health and Sanitation contracted local agencies for the importation of pesticides. In the year 2004, Alhaji Barrie of Cogo Enterprise (2C Lumley Street) supplied the Ministry of Agriculture and Food Security with 2,857 litres of malathion 50 EC. In February 2005, the Ministry of Agriculture and Food Security contracted Psmagri Chemicals (24A Juba Hill) for the supply of 11,000 litres of PFA, which was distributed nationwide. In 2006 the same Cogo group was also contracted by the Ministry Agriculture and Food Security and they supplied 3,200 litres of malathion 50EC.

Another major importer of pesticides is Complant Magbass Sugar Complex Co. Ltd., a Chinese sugar cane project. It is believed that the project imports large quantities of pesticides but the types and quantities were not disclosed. Rural farmers and pesticide traders confirmed to the Task Team that the project is their main source of accessing pesticides illegally. Some chemicals like furadan filters are supplied illegally to the farmers through Complant Magbass Sugar Complex Co. Ltd. in Magburaka, Northern Sierra Leone.



Figure 3: Food and chemicals in the same store in Kabala

Integrated Pest Management Services (31 Garrison Street) also bring in large quantities (about 16,000 litres) of various types of pesticides from neighbouring Guinea, Banjul, Europe and elsewhere.



A host of other chemicals including endosulfan 35EC, chlorpyrifos 48EC, and malathion were identified across the country. Pesticides traders, e.g., Agro Business Enterprise (42 Makeni Road, Kabala, and Fataba Street Market in Bo), revealed that the main source of their pesticides was the Republic of Guinea. A pesticide trader at Fataba Street in Bo and a retired worker in the Ministry of Agriculture and Food Security, who is now a local farmer in Kenema, were in possession of small quantities (about 10 litres) of endosulfan 35EC. They revealed that these pesticides were bought from neighbouring Guinea.



**Figure 4: Task Team investigating pesticide containers**

An agro-business enterprise at 42 Makeni Road, Kabala in the Koinadugu district also trades in pesticides of various kind smuggled from Guinea, e.g., endosulfan 35EC (16 litres) and chlorpyrifos 48 EC (10 litres).

There is no evidence for any exportation of pesticides from Sierra Leone.

Small packets of HCB were found around the country; but a stockpile of 10 sacs of 25kg each were identified at Kola store (Mahei Boima road) in Bo. No POPs pesticide waste was identified by the Task Team.

Obsolete pesticides such as Kocide 101 in 400 sachets of 50g each were discovered on the floor in the pest control store at Maxwell Kobie Street in Kenema.

11,000 litres of PFA 2000-1, which was supplied by Pesmagri and is considered to be obsolete due to its ineffectiveness, was found in different district headquarter towns. 700 litres were also found in Makeni, 400 litres in Kabala, and 2,000 litres at Kissy Dockyard in Freetown.

#### **2.3.1.4 Present management of POPs pesticides and empty containers**

There is no production of POPs pesticides and empty containers in the country.

HCB is used in the preservation of kola nut against insect pests when stored. The empty sacs are used for packing harvested crops, production of local savannah mattresses, hauling of sand and stones, etc.

HCB was also found in thick wooden boxes, possibly to prevent the chemical from absorbing moisture or to conceal it.

No stockpiles of empty containers of other POPs pesticides were identified. However, there were stockpiles of other pesticides and their empty containers across the country. These empty containers are used for various other purposes including storage of water, kerosene, palm oil, palm wine, grains,



etc. The aluminium containers of these pesticides are often recycled in the production of spoons, pots and plates.

Waste of POPs pesticides and their empty containers were not identified.

#### ***2.3.1.5 Current capacity and experience in the field of POPs pesticides***

The current national capacity and practical experience in pest management in the country are generally low. However, certain institutions like the University of Sierra Leone, the Ministry of Agriculture and Food Security, the Ministry of Health and Sanitation, the Institute of Agricultural Research (IAR), and the Rice Research Station (RRS) at Rokupr, have trained and experienced personnel in pesticide management in general.

There is no trained personnel in the management of POPs pesticides in particular throughout the country. There is no mechanism for the containment and monitoring of importation of POPs pesticides.

There are no laid down routines or procedures for the handling of POPs pesticides and pesticides in general and their empty containers. However, extension workers do train farmers in the handling and use of pesticides and their empty containers.

#### ***2.3.1.6 Environmental impact and health hazards***

Evidence of accidents in the past have shown that routines and procedures for the handling of pesticides and their empty containers are not being adhered to by both farmers and the public sector. For example, four deaths have been reported in Kamakwe and one in Magbass in the Northern Province of Sierra Leone. In the Eastern Province two crop protection workers died as a result of continuous exposure to chemicals.

The use of pesticides has certain effects on the environment. Once the pesticides have been applied their effects on both humans and animals can be persistent, affecting future generations. Some of these chemicals percolate through the soil polluting the water table. Applying pesticides for the wrong purpose such as fishing can result in pollution of surface water and affect aquatic life.

Consumption of animals killed by pesticides, e.g., rats, grass cutters, birds, and fish has inadvertently resulted in bioaccumulation in organisms/humans along the food chain, who consume these organisms.

Improper use of certain chemicals, e.g., phostoxin, can result in skin problems and sometimes instant death as reported during the survey. Misuse of other chemicals, such as HCB in the control of head lice, was reported to have caused serious damage to the scalp of some women. Improper use, storage, and application of pesticides in homes can cause death among domesticated animals and even humans.

#### ***2.3.1.7 Socio-economic implications of using or phasing out of POPs pesticides***

Through selling pesticides, employment and financial benefits are accrued by POPs pesticide traders and peddlers.

The use of POPs pesticides increases yield and quality of agricultural products and also reduces post-harvest losses. It protects the population and the environment against disease vectors.

Phasing out POPs pesticides could result in loss of income to POPs pesticide traders and peddlers



and in decrease of yield and quality of agricultural products. To avert these negative ramifications, alternatives for POPs pesticides must be found. They can be replaced by other pesticides, which are not as detrimental to health and environment, or by biological control programmes. Research on such alternatives should be supported.

### **2.3.1.8 Assignment of responsibility and liability**

At this point no legal framework for POPs pesticide management is in place. Only the Ministry of Agriculture and Food Security and the Ministry of Health and Sanitation are assigned the responsibility for the containment and disposal of pesticides.

### **2.3.1.9 Constraints for establishing a pesticides inventory**

People are apprehensive to disclose information related to pesticides. Poor road network makes it difficult to access information in some rural areas. Some distances had to be covered on foot.

Some pesticides are labelled in foreign languages such as Chinese and French which cannot be easily interpreted or classified. These pesticides are still in use for both domestic and agricultural purposes.

### **2.3.1.10 Findings and conclusions**

A wide range of pesticides has been found to be in use in the country. However, most of the POPs pesticides in question, such as DDT and dieldrin, were in use but are not used anymore in the country. Nevertheless some quantities of HCB were identified. Other POPs pesticides were not discovered, perhaps because of the difficulty in accessing information and lack of trained personnel on POPS pesticides. Certain pesticides were discovered but labelled in foreign languages (e.g., Chinese and French). Their descriptions could not be fully translated by the Task Team, but the team concluded that they were non POPs fungicides.

- 1) POPS pesticides were used before in the country. DDT and dieldrin in particular have been out of use since the late seventies and early eighties. However, HCB is still in use in Sierra Leone.
- 2) Domestic use of pesticides is more prominent in urban areas than in rural areas. Pesticides are widely used for agricultural purposes in the provinces.
- 3) The official entry of pesticides is through the Ministry of Agriculture and Food Security and the Ministry of Health and Sanitation. However, it was discovered that large quantities of pesticides are smuggled into the country.
- 4) Neighbouring Guinea is the main source of illegal entry of pesticides into the country.
- 5) Some quantities of obsolete pesticides, e.g. kocide 101, are still stock.
- 6) There are no proper disposal methods for obsolete pesticides in general. It was observed that pesticides were formally dumped into pits under the supervision of crop protection units across the country.
- 7) Malathion is the trade name widely used for most pesticides by local farmers.
- 8) The level of awareness of the public in the handling of pesticides is limited.
- 9) The use of protective gear is completely absent among users of pesticides.



- 10) Application of pesticides is supposed to be done solely by the Crop Protection Unit in the Ministry of Agriculture and Food Security for crop protection and the Ministry of Health and Sanitation for domestic purposes. However, illegal application by private individuals is rampant countrywide.
- 11) Deaths have resulted from the misuse of pesticides, namely Joko Sillah of Kissy Dockyard, David Kargbo, Junisa Sesay, David Lansana of the now defunct Produce Marketing Board died in 1985 in Freetown. Four deaths were reported in Kamakwe and one at Magbass in 2005. Similar incidents were also reported in the South and Eastern parts of the country.
- 12) Certain pesticides are still being used in fishing. Some of these pesticides are derivatives from plants. However, imported chemicals such as lindane, gammalin 20 and brestan are commonly used for same purpose.
- 13) There is no regulatory mechanism for the importation/exportation, distribution and use of pesticides in Sierra Leone. Similarly, there is no regulatory framework for the banning and licensing of commercial rights for handling of pesticides in general.
- 14) There are no influential groups, unions or associations that can lobby for the formulation of better policies and create awareness programmes to the public with regards to pesticides.
- 15) Human and material capacity in the handling and use of pesticides is limited.
- 16) Certain pesticides such HCB are still being used in the control of ectoparasites like head lice.
- 17) Empty containers/sacs of pesticides are being used for unintended purposes, like plastic containers for storing liquids such as water, palm oil, palm wine, etc. Aluminium containers are recycled for production of cooking pots, spoons, etc. Empty sacs are used in the production of savannah mattresses and for transporting and storage of food stuff such as cassava, pepper, potatoes, vegetables, etc.

#### **2.3.1.11 Recommendations**

- 1) Development of a legal framework on pesticides management: laws should be enacted by the Government and enforced by a special committee involving key stakeholders in pesticides for the importation, distribution and safe use of pesticides.
- 2) Stockpiles of obsolete pesticides and empty containers should be properly disposed of under the supervision of competent authorities. Existing storage sites such as stores of the Crop Protection Services Units in the provinces (Bo and Kenema) should be cleaned.
- 3) Strengthening of institutional capacities (human and material) on POPS pesticides and pesticides: more personnel in government institutions and the line ministries dealing with pesticides should be trained and equipped in the handling and use of POPs pesticides and pesticides in general.
- 4) The level of awareness should be increased by a mass sensitisation campaign on the health hazards on handling, use and storage of pesticides and their empty containers.
- 5) The civil society and CBOs should be empowered in monitoring the handling, use, and illegal possession of pesticides throughout the country.
- 6) A mechanism for collection and disposal of empty pesticides containers should be installed.



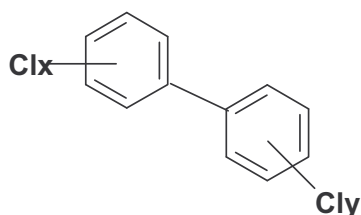


## 2.3.2 PCB inventories

### 2.3.2.1 Introduction

#### *Chemical properties, distribution, health and environmental effects*

PCBs (polychlorinated biphenyls) are chemicals that were discovered towards the end of the 19<sup>th</sup> and the beginning of the 20<sup>th</sup> centuries with their commercial production and use commencing in the late 1920s. The systems in which they are used are as diversified as the purposes for which they are used. They may be represented by the general structural formula:



Since there are 10 positions for substitution, it follows that the maximum number of chlorine atoms that can be found in a PCB is 10. A total of 209 isomers/congeners exist and of these only 110 are present in commercial mixtures. They are virtually insoluble in water but very soluble in liquid hydrocarbons and fats. They show colours ranging from pale yellow to brown. They fail to crystallise on cooling and form resins instead. PCBs are fire resistant, have high flash points, are resistant to thermal decomposition, show low electrical conductivity and high thermal conductivity.

Because they are so chemically inert, they are regarded as one of the most stable compounds ever made by man. This feature contributes to their persistence in the environment and their tendency to bio-accumulate. Unfortunately, the very properties that make them suitable for their diverse use also render them a threat to life and the environment. PCBs are widely distributed in the environment and this is due to their persistence and mobility. They are literally everywhere in the world including the Arctic, Antarctica and the remote Pacific Islands. PCBs occur in the tissues of every human being on earth. They evaporate and can therefore be transported by air and also as adsorbate on particles. The so-called “grasshopper effect” in which PCBs condense on surfaces at low temperatures, evaporate at high temperatures, and are transported into the air to condense when the temperature drops, contributes to their distribution. In water PCBs are adsorbed on sediments. Certain processes, such as dredging of estuaries, may lead to their release into the water column and their subsequent transport much further afield.

Laboratory studies have revealed that PCBs cause tumours in animals and may be carcinogenic in man. They alter reproductive processes at very low concentrations and occupational exposure in human may result in a skin condition called “chloracne”. Loss of body weight, impaired immune response, impaired liver function and adverse effects on the central nervous system are among the health effects associated with PCBs. Human exposure routes include direct skin contact, ingestion in contaminated food and inhalation of contaminated dust. In the body, PCBs are primarily stored in the adipose (fat) tissue but have also been found in blood serum and breast milk. Individuals who have no direct contact with PCBs may have been contaminated through the food chain.

Environmental degradation of PCBs is rather slow and the rate decreases with increase in chlorine content. The degrading processes include hydrolysis and microbial processes. In anaerobic conditions, reductive de-chlorination to lower chlorinated congeners facilitates subsequent microbial degradation. Bio-concentration in marine organisms can result in 200 - 70,000 times the average PCBs level in the open ocean.



### 2.3.2.2 Sources of PCBs

The applications of PCBs have been classified as: closed, partially closed and open.

*Closed applications:* systems in which the PCB is contained in sealed equipment. These include electrical transformers, electrical capacitors, such as power factor capacitors in electrical distribution systems, lighting ballasts, and motor start capacitors in electrical equipments such as televisions. Other minor closed applications include electric motors and electromagnets.

*Partially closed applications:* heat transfer fluids, hydraulic fluids, vacuum pumps, switches, voltage regulators and circuit breakers.

*Open applications:* lubricants, casting waxes, surface coatings, adhesives, plastics and inks.

Likely sources of PCBs in developing countries are power generating stations, power distribution networks and transformer stations.

The above consideration points to the wide range of applications of PCBs and this makes the production of an inventory a complex business. In view of this the Task Team prioritised based on the experience of other countries which have already addressed the PCB issue. The main sources inventoried are transformer units.

#### 2.3.2.2.1 Study Objectives

- 1) To identify the various sources and current status of PCBs in the country
- 2) To assess existing policies and the level of awareness about PCBs

#### 2.3.2.2.2 Methodology

##### *Initial identification of PCBs*

The methods used here do not involve chemical analysis. Two basic assumptions are made:

- If there is no name plate indicating the type of dielectric, the transformer is assumed to contain 500 ppm or greater PCB concentration.
- If it is known that the transformer contains mineral oil but the PCB concentration is not known, it is assumed that the PCB contraction is between 50 - 499 ppm.

At this stage:

- 1) Possible target locations for PCBs are identified and inspected.
- 2) The potential PCB containing applications at the target location are determined.
- 3) All transformers and capacitors are inspected for PCB marks/labels.
- 4) PCB trade names are sought to obtain an idea of other closed or partially closed applications.
- 5) All potential open applications are included.
- 6) All PCB contaminated materials/wastes are included.

The above procedure is called the step by step approach and can be followed by testing and analysis of samples to verify PCB concentration.



Based on the experience of other countries, supplier/manufacturer information may give an indication of PCB-containing equipment. If there is no name plate then there may be a manufacturer's mark. It is important to ensure that the unit is not a refitted transformer which has been filled with new dielectric for which there is no record. Where possible the supplier/manufacturer is approached to provide the relevant technical information. Name plates on capacitors and some transformers manufactured in the USA after 1978 are labelled "NO PCBs".

Equipment supplied from other countries may have no markings at all.

The following is a list of some manufacturers/suppliers:

Asea and Sieverts	National Industry	SPA Condensator
Nokia	General Electric	PR Mallory
Siemens	Westinghouse	Sangamo Electric Co.
Sprague	Liljeholmen	Electric Utility
ACEC	Aerovox	Cornell Dubilier
AEG	Univ. Manufacturing Corp.	

Expected information on name plates includes:

- Name of manufacturer
- Serial number
- Electrical specification
- Year of manufacture
- Weight of unit
- Volume/weight of dielectric

If the dielectric is labelled non-PCB, service records are inspected to check if it has been topped with non-PCB oil. It is possible that the unit may have been recycled and the original dielectric replaced. Note, however, that though name plates give a good indication of the PCB content they are not 100% reliable.

Many different trade names are used for PCB-containing oils in transformers and capacitors and these appear on name plates. In order to identify those that contain PCBs, the European Union has produced a list of common PCB trade names. This list is used as a guide in identifying PCB containing transformer/capacitor oils.

#### 2.3.2.2.3 Survey results and findings

##### *Sources of PCBs and their current status*

The National Power Authority (NPA) and the Bo-Kenema Power Services (BKPS) are the major providers of electricity nationwide. NPA provides electricity in the Western Area including the Freetown municipality and the Mountain Rural District, while BKPS caters to the Southern and Eastern provinces. The Northern Province is currently fed on small power generating units that do not need many transformers. All government and non-governmental organisations/institutions nationwide depend on power supplied by NPA or BKPS or power supplied by small units that do not require transformers.





**Figure 5: Main transformer receiving current from source - Bo**

The Western Area electricity sector operates 208 large to medium size transformers and circuit breakers but only 187 are functional, the others are redundant even though they have not yet been decommissioned. There are also records of pole-mounted transformers used in the mountain rural districts, which have been decommissioned and replaced by medium-sized transformers.

The survey covered all these transformers together with 12 others that have been decommissioned, 6 owned by NPA and the other 6 by BKPS. 3 of the decommissioned transformers (2 at NPA and 1 at BKPS) were destroyed during the war. The transformer oils in them were reported to have been spilled at their locations before decommissioning. Some of the decommissioned transformers were reported to have been dismantled and the metal parts carted away by certain unscrupulous members of the public and possibly sold as metal scrap.

Out of the 249 transformers operated by both NPA and BKPS containing 176.834 metric tonnes of transformer oil, 179 transformers containing 103.372 metric tonnes of oil were manufactured before 1978. Based on the date of manufacture criterion and simple tests involving density measurements, the 103.372 metric tonnes of oil in the transformers manufactured before 1978 possibly have PCB concentrations at 500 ppm or above. The remaining 73.462 metric tonnes may contain PCB concentrations between 50 to 499 ppm. Oils in the decommissioned transformers were reported to have been drained and re-used or disposed of at their previous locations. Visible indications of oil leaks from transformers and possible spillages of used oil during maintenance work were noted at most sub-stations.

The Western Area has 145 PCBs contaminated sites while the Southern and Eastern regions have 16 and 18 respectively. All these sites were considered as priority because of their proximity to residential areas, schools, water bodies, farm animals and food processing units.





Figure 6: Oil spillage at the BKPS Kenema reservation sub-station

It could therefore be postulated that nearly 3/4 of the transformers in Sierra Leone contain greater than 500ppm PCB levels while 1/4 is considered to be without PCBs. The size of transformers was estimated by the Task Team in terms of their power rating (see Table 6). Their PCB contents have yet to be assessed. All these transformers are yet in service. Transformers installed from 1936 to 1999 could not be in service up till 2025. Only transformers installed from 2000 to 2006 would be in service up till 2025.

Table 6: Approximate transformer sizes in KVA

No	Substation	KVA	No	Substation	KVA	No	Substation	KVA
<b>Bo District</b>								
1	Njala University Torwama	300	2	Water work, Gelehun	300	3	New London	315
4	Bo Pujehun	315	5	Benni Mix	500	6	New Police Barracks	500
7	Jarahun	630	8	Yemoh Town	630	9	Y-Junction	750
10	T. Konko Rd. Power house	800	11	SDA	800	12	Njai Town	800
13	Sewa	800	14	Reservation North	800	15	Kandy mountain	800
16	Police station	800	17	Hospital Rd.	800	18	Kandy street	800
19	Kawesu	1000	20	Reservation, south	1000			
<b>Kenema District</b>								
1	Koroma street	800	2	Maldonald street	800	3	Mornya streeet	800
4	Police station	630	5	Hagai Rd.	630	6	Damah Rd.	300
7	Mission Quarter	800	8	Milkailu street	800	9	Jarahun Rd.	800
10	Lapia street	500	11	Police Barracks	800	12	Polyteck	300



No	Substation	KVA	No	Substation	KVA	No	Substation	KVA
13	Water work	300	14	Reservation	800	15	Wai street	750
16	Brima street	750	17	Kandy street	800	18	Lebbie street	1000
19	Saffa street	1000						
<b>Western Area</b>								
1	33 Substation	25	2	National Workshop	50	3	Jui Bibble College	50
4	Majay Town	50	5	Mile 13	75	6	Benz Town	75
7	Oku Town	75	8	Hamilton	100	9	Lower Allen Town	100
10	Adonkia	150	11	Guma p/s Tower Hill	150	12	APT- Safecon	150
13	Bangura Farm	150	14	Leicester	150	15	Regent Villag	150
16	GUMA P/S-Hill Station	160	17	New Jerusalem	160	18	Ogoo Farm	160
19	Kossoh Town	160	20	Rokel Village	160	21	Foamex	200
22	Mayami	200	23	Hasting Village	200	24	Milhen Flat	300
25	Wilberfore No. 1	300	26	Wilberfore Barracks	300	27	Jamil Fla	300
28	Goderich Village	300	29	Michaels- Lakka	300	30	Cole Farm	300
31	Casino	300	32	Chineses compound	300	33	Hill cot	300
34	Guma Building	300	35	Ordinance Yard	300	36	Flour Mill	300
37	PWD-Kissy	300	38	Kissy Village	300	39	Lower personage	300
40	Thunderhill	300	41	Odugu	300	42	Kortright	300
43	EU	315	44	Nigeria High Comm.	315	45	President Lodge	315
46	Sawi Drive	315	47	Kabassa Lodge	315	48	Penninsular Rang	315
49	MMCET	315	50	Smithley	315	51	Sussex	315



No	Substation	KVA	No	Substation	KVA	No	Substation	KVA
52	Cape Light House	315	53	Kimbima Hotel	315	54	Tengbeh Town	315
55	Brookfield Hotel	315	56	Mandally	315	57	Kington Police pkg	315
58	Kissy House	315	59	Soldier Street	315	60	SLET	315
61	Parliament	315	62	State House	315	63	Kenedy St.	315
64	Blackhall Rd	315	65	Station X	315	66	Hotel 510	315
67	Mbil- Kissy	315	68	Kissy Police Barrack	315	69	Clarke Street	315
70	Paint	315	71	Cola Tree	315	72	Spring water Grafton	315
73	Polie Barrack Grafton	315	74	Waterloo Village	315	75	Kortght pkg	315
76	Cockerill H.Q	400	77	Benguema	400	78	Hill Station	500
79	Wilberfore No. 2	500	80	Spur Loop	500	81	Signa Hill	500
82	W.T	500	83	Juba Hill	500	84	Juba Local	500
85	Cockerill	500	86	Lower pipeline	500	87	Technical	500
88	Murray Town Bks	500	89	Alpha Fishing	500	90	Okeyy Fishing	500
91	Riverside Drive	500	92	Morgan street	500	93	Kington workshop	500
94	SLC Bank Liverpool st	500	95	Ministerial	500	96	Facom Bridge	500
97	Leone Building	500	98	Lotto	500	99	Paramount Hotel	500
100	Leocem Factory	500	101	Lower Mamba Ridge	500	102	Africanus Rd	500
103	Clay Factory	500	104	Old Soap	500	105	Brewery1	500
106	FBC1	500	107	FBC2	500	108	Oil Refinery	600
109	Oil Refinery	600	110	Ropoti	600	111	IMATT-Hill Station	630
112	Bai Bureh Rd	630	113	Choithram Hospital	630	114	Spur Military	630



No	Substation	KVA	No	Substation	KVA	No	Substation	KVA
115	Guma- Spur Road	630	116	Lumley H. Centre	630	117	Lumley Local	630
118	Majay Town	630	119	SLBS Goderich	630	120	India Temple	630
121	Grammar Sch	630	122	Bintumani Hotel	630	123	Mammy Yoko	630
124	Cape Sierra	630	125	Brookfield Local	630	126	George Brook	630
127	Henessy Street	630	128	Priscilla street	630	129	Joaque Bridge	630
130	Nursing Troining sch.	630	131	Connaught Hospital	630	132	UMC	630
133	Cotton Tree	630	134	NIC	630	135	Government Wharf	630
136	East Street pkg	630	137	Catholic Mission	630	138	Daily Mail	630
139	Ammunition Dump	630	140	Regent Rd	630	141	Savage Square	630
142	College Rd	630	143	Tajco	630	144	Slip Way	630
145	Milla Plastic-kissy	630	146	Low Cost Housing	630	147	SLTU	630
148	Brewery2	630	149	Natco	630	150	Congo Water	630
151	Farmco	630	152	Sister Mess	750	153	P.WD Pandemba Rd.	750
154	Mandallay Factory	750	155	Electrical House	750	156	Rockel Comm.Bank	750
157	Rawdon street	750	158	Mountain Cut	750	159	Fisheries Kissy	750
160	Dock Yard 1	750	161	Dock Yard 2	750	162	HBC	800
163	UAC	800	164	Bank of S/L-New	800	165	OAU	1000
166	P and T	1000	167	Spur Rd.	1000	168	Sterling product	1000
169	Collegiate	1000	170	Bata Plastic	1000	171	Congo Cross	1000
172	Aberdeen Village	1000	173	Government printing	1000	174	New England	1000
175	Bank of S/L-Old	1000	176	Comm. Bank H.Q	1000	177	Eastern Police	1000





No	Substation	KVA	No	Substation	KVA	No	Substation	KVA
178	PCMH	1000	179	Flour Mill Factory	1000	180	Water Quay	1250
181	Shankerdas	1250	182	SLPMB 1	1250	183	SLPMB 2	1250
184	SLPMB 3	1250	185	Oku Town	75	186	Regent Village	150
187	Majay Town 2	50						

The survey showed that workers at both NPA and BKPS and the general public were not knowledgeable (in fact, completely ignorant) about PCBs and their environmental and health hazards. A senior officer at NPA affirmed that no safety gears had been used or precautionary measures taken in handling oils containing PCBs before the survey. They reported cases of transformer oil theft, especially from faulty transformers that have not yet been decommissioned and located at sites within community reach. As a result of concerns raised by several environmental safety groups, NPA has been able to develop a World Bank sponsored environmental monitoring and clean-up project with the tasks of monitoring PCB levels in transformer oils, carbon emission, safe disposal of used marine oil, etc. at the Kingtom power station.

Hydraulic and brake fluids are mainly imported into the country by petroleum companies (Safecon, Total, National Petroleum, etc.) The brands imported are suspected to contain some low levels of PCBs by the simple density measurements done on them. However, chemical analysis is required to ascertain the actual levels of PCBs in these products. Paradoxically the Lockheed super 105 (DOT 3 & DOT 4, boiling point 255°C, SSB215) brake fluid has been confirmed to be used by some members of the public as a body lotion that is purported to cure certain skin diseases.



**Figure 7: Transformer name plate in Bo-Kenema**

The normal practice of disposing of used hydraulic fluids by automobile mechanics/fitters at garages is by discharging them into street drainages, some of which lead to streams, rivers, etc. This is a serious concern as most of the products carry on their containers cautions like: “Harmful to aquatic organisms” or “Must be disposed of using local authority disposal facilities”. The survey found out that there are basically no such facilities available to those who use or work with these fluids, which is a recipe for gross environmental pollution. In some cases it is reported that used hydraulic and other fluids are given or sold to interested persons who use them for lighting wood fire or as lubricant for timber milling blades in the local industry (cottage timber industry).



The open application of PCBs has been a concern to the survey as it is one of the ways the public interacts directly with these substances. The survey noted that the two factories involved in the production of paint (Rainbow Paints) import chemicals which may contain PCBs. The other open applications such as adhesives, lubricants, etc., have not been covered by the survey due to certain limitations.

Wastes containing PCBs have been found at almost all dumpsites in and around Freetown and the other cities (Bo, Kenema and Makeni). These range from office wastes comprising used stationary, computer parts, etc., municipality and engineering wastes including drainage sludge and sediments (likely polluted with used oils containing PCBs). The survey noted the unhygienic location of a Chinese owned distillery along the Freetown-Waterloo highway. It distils spent marine oil (likely mixed with transformer oil) generated by the NPA and BKPS to obtain diesel oil that is traded locally. The residue is littered around the vicinity of the distillery that is in the neighbourhood of Rokel Village.

### ***2.3.2.3 Existing regulations and public knowledge with reference to PCBs.***

There is no existing law/regulation that specifically prohibits/controls the importation/use of goods containing PCBs. The Environment Protection Act 2000 broadly refers to the control of environmental pollutants but does not specifically mention PCBs. The responses deduced from the survey affirm that the presence of PCBs in some goods and their effects on human health and the environment is news to the general public. In this regard, there is an urgent need for an intensive nationwide public awareness campaign on these issues. This should be coupled with the development, enactment and enforcement of a legal policy framework that should monitor the production/importation or use of goods/equipment containing these substances if Sierra Leoneans should be saved from their environmental and health effects.

### **2.3.3 UPOPs Inventories**

#### ***Summary***

The Stockholm Convention requires the signatories to take measures to reduce emissions in view to eliminating the unintentional production of Persistent Organic Pollutants (UPOPs). Sierra Leone, being a signatory to this convention, organised a team of researchers to compile an inventory of UPOPs as a first estimate using UNEP's Standardised Toolkit. The following objectives were targeted:

- To identify all sources and assess the current situation of PCDD/PCDF in Sierra Leone's environment
- To estimate the quantity of the various sources as a first estimate of the magnitude of release
- To evaluate the impact of the emissions on environment and human health, using UNEP's Standardised Toolkit for Identification and Quantification of Dioxin and Furan Releases.

The following approaches were used to carry out the survey:

#### ***Data gathering***

- Literature review
- Pooling information from the knowledge and expertise of the team
- Collection of primary data



### *Characterising release sources*

- How much is released per unit?
- What are the factors which influence the release of dioxins and furans?
- How much information is available about the release sources?
- Key uncertainties

### *Deriving a national inventory*

- Identifying key sources
- Identifying potentially effective control measures

No prevention and control mechanism was identified, and it is worth noting that dioxins and furans are highly toxic to humans and animals; they are persistent, lasting for years or even decades before degrading into less dangerous forms; they evaporate and travel long distances through the air and through water; and they accumulate in fatty tissue. It is very common to see Sierra Leoneans with persistent health problems yet no disease diagnosed.

Most of the sources outlined in UNEP's Standardised Toolkit were identified. The most prominent of all were uncontrolled combustion processes at homes, dumpsites, farms/gardens, etc. The only reliable available information on the current situation at this point is the accumulation of the pollutants due to daily practices relating to their release (plastic burning, etc.)

Emission factors as prescribed in UNEP's Standardised Toolkit were used to calculate the estimated quantity of UPOPs released. The resulting total UPOPs emissions are 646.16g TEQ into air, 0.09g TEQ into water, and 8.00g TEQ to land and 588.01g TEQ to residue are released per annum.

#### **2.3.3.1 Introduction**

The Stockholm Convention requires signatories to take measures to reduce emissions with a view to eliminating the unintentional production of Persistent Organic Pollutants (UPOPs).

##### *2.3.3.1.1 Some common sources*

Domestic combustion processes favour the formation of PCDD/PCDF when

- Moderate temperatures (200 - 450<sup>0</sup>C) are commonly achieved
- Low oxygen conditions with high particulate surface area are common
- Materials containing chlorine and trace metals are commonly burnt

Emissions from domestic sources readily result in

- Direct inhalation
- Spreading on land

Examples of processes releasing PCDD/PCDF into air include off-gases from

- Combustion processes
- Metal processing operations, e.g., sintering, metal smelters, etc.
- Drying and baking operations, smoke houses, etc.



- Other industrial thermal processes, e.g., pyrolysis, ash recycling, cracking, etc.

Examples of processes releasing PCDD/PCDF into water include

- Wastewater discharge from pulp and paper production, especially when elemental chlorine is used
- Wastewater discharge from chemical production processes, especially when elemental chlorine is used
- Wastewater discharge from the use of dioxin-contaminated preservatives or dyestuffs for textiles, leather, wood, etc.
- Other wastewater discharge from processes identified to be associated with PCDD/PCDF in at least one of the four other environmental compartments and/or media
- Wastewater discharge from normal household operations (washing machines, dishwashers, etc.) when clothes or other textiles and/or detergents that contain PCDD/PCDF, are present.

Release of wastewater in the form of leachate into surface waters and/or groundwater may be deliberate or unintentional. Examples of this source include

- PCDD/PCDF-contaminated sites
- Industrial sites where phenol and chlorinated aromatic compounds are used
- Waste dumps and junk yards, especially when PCDD/PCDF-contaminated production residues or waste oils have been disposed

Release to land comes from

- PCDD/PCDF contaminated product or waste use, e.g., pesticides, wood preservatives
- Application of sewage sludge on farm land or compost in gardens
- Direct disposal of PCDD/PCDF containing wastes on land; e.g. ashes left from open burning
- Deposition of PCDD/PCDF to land via the atmosphere

#### 2.3.3.1.2 Study objectives and expected outcomes

**Table 7: Objectives of the UPOPs inventory study**

Objectives	Activities	Expected results
To identify all sources and releases of PCDD/PCDFs into Sierra Leone's environment	Identify and list all sources of UPOPs in the environment Identify the ways of generation, management and elimination of UPOPs in the country Identify the situation of UPOPs contaminated wastes	Sources of UPOPs are identified and listed The flow mechanism is understood UPOPs contaminated sites identified
To estimate the release quantities of the various sources	Quantify the various sources based on research reports and calculations from findings by the Team Incorporate conversion factors as per the UNEP Standardised Toolkit	Approximate quantities of UPOPs releases estimated



To evaluate the impact of the emissions on environment and human health, using UNEP's Standardised Toolkit for Identification and Quantification of Dioxin and Furan Releases

Identify the target groups regarding the disposal or recycling of wastes  
Identify the groups of people that are affected by UPOPs in the country

People exposed to or already affected by UPOPs are identified

### 2.3.3.1.3 Methodology

#### *Data gathering*

- Literature review
- Pooling information from the knowledge and expertise of the team
- Collection of primary data

#### *Characterising release sources*

- How much is released per unit?
- What are the factors which influence the release of dioxins and furans?
- How much information is available about the release sources?
- Key uncertainties

#### *Deriving a national inventory*

- Identifying and quantifying key sources
- Identifying potentially effective control measures

### 2.3.3.2 Key Sources

#### 2.3.3.2.1 Category 1: Waste incineration

##### *Combustion of medical waste*

There is one so-called incinerator at the Makeni Government Hospital, in the Northern Province. The waste is inserted into two small openings of a bore hole that is paved, and then put on fire to burn. A lot of smoke is emitted as a result of incomplete combustion.

#### 2.3.3.2.2 Category 2: Ferrous and non-ferrous metal production

Sierra Leone does not have any industry for ferrous or non-ferrous metal production.

#### 2.3.3.2.3 Category 3: Power generation and heating

##### *Domestic heating and cooking*

The quantities of domestic solid fuel and numbers/types of combustion appliances can be reasonably well understood: wood/dry biomass, charcoal, petroleum products. Plastic materials are often used to kindle the burning of wood and charcoal. This is happening on a daily basis and so could contribute to increased flow of the PCDD/PCDF to the environment.



Emissions of dioxins and furans depend on

- Chlorine content of fuel
- Combustion conditions
- Oxygen levels
- Quantity of soot
- Appliances used

#### *Small generators*

Starting with the assumption that 56,851 generators consume 0.5 litres of gasoline daily on 365 days per year, the total quantity of gasoline consumed in tonnes would be, considering that 1 litre of gasoline weighs 0.74 kg:

$56,851 \text{ generators} \times 0.5 \text{ litres} \times 0.74 \text{ [kg/litre]} \times 365 \text{ days} = 7,677,000\text{kg}$  or 7,677 tonnes.

UPOPs emission =  $2.5\mu\text{g TEQ/T} \times 7,677 = 0.019 \text{ g TEQ/a}$ .

Biomass is the major renewable energy used in Sierra Leone's households for cooking. The forest and agricultural by-products provide the main source of fuel wood used. Under the assumption that the heating value of 1 kg of wood is 14 MJ and that almost all wood burned is collected in the forest and therefore virgin wood:

- 4.9 million people burn 1 ton of wood per year each
- 1 ton of wood has a heating value of 14 GJ or 0.014 TJ
- 4,900,000 tons of wood have a heating value of  $0.014 \times 4,900,000 = 68,600 \text{ TJ}$
- Virgin wood has emission factors of  $100 \mu\text{g TEQ/TJ}$  for air and  $20 \mu\text{g TEQ/TJ}$  for residue
- Emission to air is  $100 \times 68,600 = 6,860,000 \mu\text{g TEQ/year}$  or 6.86 g TEQ/year

The combined UPOPs emission of small generators and domestic cooking is  $0.019 + 6.86 = 6.88 \text{ g TEQ/year}$ .

#### *2.3.3.2.4 Category 4: Production of mineral products*

The only significant source in this category in Sierra Leone is the cement production. The factory produces 456,250 tonnes of cement per year. With an emission factor of  $5 \mu\text{g TEQ/t}$ , the emission into air is 0.274 g TEQ/a.

#### *2.3.3.2.5 Category 5: Transport*

The total number of vehicles of all categories assumed to be in Sierra Leone is 264,697 (source: Road Transport Authority Magazine; Vol.1 No. 2, 2006).

All these vehicles use one of the two types of fuel. 85% of the vehicles imported are used cars, and 80% of them use gasoline. Since it is not clear what percentage of gasoline is leaded, it was assumed that all of it is leaded/

$80/100 \times 264,697 = 211,758$  gasoline vehicles and 52,939 diesel vehicles



The annual fuel consumption would be for gasoline

$211,758 \text{ vehicle} \times 5 \text{ litres} \times 365 \text{ day} \times 0.74 \text{ (kg/l)} = 285,979,179 \text{ kg/year} = 285,979 \text{ tonnes/year}$

For diesel the same calculation yields

$52,939 \text{ vehicle} \times 5 \text{ litres} \times 365 \text{ day} \times 0.85 \text{ (kg/l)} = 82,121,624 \text{ kg/year} = 82,122 \text{ tonnes/year}$

Assuming that it is leaded, the emissions would be  $2.2 \mu\text{g TEQ/t} \times 285,979 \text{ tonnes/year} = 0.629 \text{ g TEQ/year}$  for gasoline and  $0.1 \mu\text{g TEQ/t} \times 82,122 \text{ tonnes/year} = 0.008 \text{ g TEQ/year}$ .

#### 2.3.3.2.6 Category 6: Uncontrolled combustion processes

##### *Domestic waste combustion*

Combustion of domestic waste is a major source of dioxins and furans, as this is one of the main means of getting rid of household waste. Part of the household waste comprises of plastics and other materials containing chlorine and metals that act as reactants in the formation of PCDD/PCDFs. Residues are likely to be left at the site, which may introduce the PCDD/PCDFs into the soil. There has been an increase in the volume and complexity of waste.

Key uncertainties for the calculation are the amount of waste burnt and the plastic and chlorine content of the waste, the presence of copper (catalyst) and sulphur (inhibitor). Other little known factors are the combustion conditions (oxygen level, air mixing, temperature) and the presence of metals.

##### *Dumpsite waste combustion*

Waste combustion at dumpsites is likely to account for most of the dioxins and furans generated in the cities of Sierra Leone. The main dumpsites of the cities of Freetown, Bo, Kenema and Makeni use open burning as one of the main ways of reducing the volume of waste, to allow for continuous flow. No sorting mechanism was identified and so plastic and other chlorine/toxic metal containing substance are usually burned in combination with animal and plant waste. In addition to the main dumps, self created dumps are seen all over the place in all the cities and towns. Village communities mainly bury their waste at backyards or are incorporated into gardens. Residues are likely to be left at the site and subsequently end up in the soil and water bodies.

Key uncertainties:

- Source of ignition: explosive gases, accidental fires in dumped waste or deliberate burning
- Amount of waste burnt
- Plastic and chlorine content of waste
- Presence of copper (catalyst) and sulphur (inhibitor)
- Presence of trace metals and other chemicals
- Emissions depend on details of combustion

The key influences on emissions are:

- Combustion conditions (oxygen level, air mixing, temperature)
- Presence of metals
- Chlorine content of waste



#### Emissions from waste burning:

The total waste quantity was estimated at 1.76 kg/person/day or 980,025 tonnes per year in total. It was assumed that half of this quantity is burnt at households and the other half at dumpsites. Since the emission factors into air are 300µg TEQ/t for domestic waste and 1,000µg TEQ/t for dumpsites, an average factor of 650µg TEQ/t was used. The emission factor into residue is the same for domestic waste and dumpsites.

650µg TEQ/t x 980,025 tonnes equals 637 g TEQ/a, emission into air. As for emission into residue, the calculation yields 600 µg TEQ/t x 980,025 t/year = 588 g TEQ/a.

There are significant agricultural and crop residues burnt; the quantity of such biomass that undergoes uncontrolled combustion is estimated at 2 million tonnes per year. These include animal waste, rice straws, sawdust, cocoa pods, bush fires, etc.”

Estimated emission from uncontrolled burning can be calculated as

Release into air: 5 µg TEQ/t x 2,000,000t/a = 10.00 g TEQ/a

For Land: 4 µg TEQ/t x 2,000,000t/a = 8.00 g TEQ/a

#### 2.3.3.2.7 Category 7: Production of chemicals and consumer goods

These are small scale industries with no significant contribution to Sierra Leone’s overall UPOPs emissions.

#### 2.3.3.2.8 Category 8: Miscellaneous

Most of the sub-categories refer to practices not common in Sierra Leone, such as crematoria or dry cleaning. An estimated 4,900,000 million cigarettes smoked per year cause 0.00018 g TEQ/a emissions into air.

#### 2.3.3.2.9 Category 9: Disposal/landfill

##### *Landfill leachate*

Waste dumps are a major source of PCDD/PCDF contamination to water. There are two main dumpsites in Freetown, Granville Brook and Bormeh King Tom, and many self created dumpsites all of which are situated by water ways. This same situation applies to the cities of Bo in the south (two main dumpsites), Kenema in the east (one main dumpsite), and Makeni in northern Sierra Leone (one main dumpsite). Many activities that lead to leaching of chemicals, surface runoff, etc., happen on a daily basis; the dumpsites are normally situated in valleys that are flanked by water bodies.

Key uncertainties are the amount of PCDD/PCDF-containing wastewater discharged into waters and the amount of leachate from dumpsites.

Application of sewage sludge to the land is a major practice both in the houses and at dumpsites. All cesspit bowsers empty their contents at the Bormeh King Tom dumpsite directly on the land. This is similar in other cities. Most of the homes in the country empty their sewage sludge in dug holes at the backyard (pit latrines and few septic tanks).

All categories of waste are dumped at backyards and dumpsites. The ashes left from burning are mostly applied to gardens or are just abandoned.





Key uncertainties for release of UPOPs to land are the quantity of sewage sludge dumped on land, the quantity of ash residue, and the quantity, and complexity of waste dumped on the land.

#### *Open water dumping*

There are few industrial processes in the country but continuous discharge of wastewater into streams goes on. The industrial activities include brewing and beverage production, small scale gara tie-dyeing, soap making, etc.

Wastewater discharge from homes may account for most of the UPOPs release to water (dish waters, soap water, wash water, direct dumping of sewage sludge and other waste types).

Assuming 10L of waste water is released per person per day, the estimated release into water per year is  $10L \times 4,900,000 \times 365 \times 5\text{pg TEQ/L} = 0.089 \text{ TEQ/a}$

#### *Waste oil disposal*

Oil spillage is very common in all operating power stations either in drainages or at the edge field of small streams and swampy areas. Figure 8 is a distinctive example of such common place at the Bo-Kenema power station. There is no evidence of proper handling facilities even at the power stations in Freetown. At this time, the Toolkit does not yet give any emission factors for waste oil.



**Figure 8: Direct disposal of waste oil into drainage close to the Bo-Kenema Power station**

#### *2.3.3.2.10 Category 10: Hot spots*

All the residues of the above mentioned processes are normally just discarded. They usually find their ways into water bodies through surface runoff, or in the soil through leaching. There have recently been extensive gara tie-dyeing activities; such activities are normally characterized by the use of chlorinated chemicals for bleaching purposes. These chemicals find their way into water bodies, the soil or the air. There is the Forest Industries Corporation in Kenema district; insecticides and disinfectants are normally applied to the processed timbers. The SRL mine sites have two dredges that remove a great portion of the earth, thereby creating ponds; the bauxite mines also remove a great portion of the earth. There used to be one bauxite and iron ore mine in the north.



At all enterprises that are likely to cause pollution environment departments should be established/strengthened for data base management in order to enhance compliance to the prevention and control of pollutant release.

The following hot-spots were identified by the Task Team:

- Kenema Forest Industries Corporation in the Eastern Region
- Rutile mining company and Bauxite mining company in the Southern Region
- Iron Ore Mining Company in the Northern Region
- Magbass Sugar Cane Industry also in the Northern Region



**air status in Sierra Leone**

Analysis	Opportunities for action
<p>burning of waste was found at the Makeni Government Hospital, northern Sierra called incinerator. There is a small opening at a covered and paved hole through e is inserted and ignited. This enhances incomplete combustion and possible oxins and furans.</p>	<p>Education on proper incineration technologies and environmentally friendly ways of waste treatment</p>
<p>ral metal workshops all over the country; they vary from blacksmiths to building and e entrance of most villages are characterised by a blacksmith specialised in recycling machetes, hoes, axes, knives, pots, etc. The metals are subjected to high enhance softening and reshaped. In towns and cities the workshops design and of products that are sold to the public, private companies, government offices and erials used by these workshops are mainly new metal sheets that are bought by used metals recovered from garages, industries and waste dumps. These metals are rap metal dealers or scavengers. The products manufactured include building ultural equipment, mining equipment, furniture, cooking stoves, and domestic s buckets, knives, etc.</p>	<p>Education on friendly technologies that will enhance reduced emission of dioxins and furans from such processes</p>
<p>roliferated with small generators to give electricity to homes and small scale s. There is also a small collection of big plants that are used by industries. The main om the National Power Authority (NPA) in Freetown is suffering from a long halt. The uthern parts of the country are mainly supplied by the Bo-Kenema Power Service lectric power source. Companies like Sierra Rutile Limited (SRL) in the south, Sierra Company (SLDC) in Bo and Kono, Koidu Holdings in Kono, etc., use their own o supply power. However, access to information as to the quantity, type and waste of ot available.</p>	<p>It is crucial to access data on the details of fuel and other processes, to help enhance accuracy as regards release of by-products in the country. Collaborative partnering could help ensure the achievement this desire.</p>
<p>als resources (Diamond, Rutile and Bauxite) are mined in the south and east of the ajor by-products are oil leaks, dust, wastewater discharge and smoke from exhausts.</p>	<p>Environment departments to be established/strengthened for database management in order to enhance compliance to the prevention and control of pollutant release.</p>

Analysis	Opportunities for action
<p>use gasoline 4-stroke engines. There are few boats on the sea and demand for motor increase. It is common to see heavy smoke (sooth) from most of these vehicles, es.</p>	<p>Policy formulation to prevent the continuous release of the probably polluted smoke from exhaust pipes, and the discharge of similarly contaminated waste liquids.</p>
<p>practice in the entire country. There are daily accidental fires, bush fires, etc. almost always on fire, mostly as a result of explosive gases and left out burning the source of a continuous flow of smoke which sometimes causes fatal road only in Freetown where one can get fire prevention service, though very ineffective. little information on the number of fire accidents in the country.</p>	<p>Establishment of sanitary landfills in the country is crucial. Increased institutional capacity at the National Fire Prevention Centre (Fire Force) is also crucial.</p>
<p>erator of UPOPs in Sierra Leone, since no major productions exist.</p>	
<p>predominantly practiced in the Western Area and some parts of southern Sierra smoking is legal and many Sierra Leoneans are accustomed to the habit.</p>	<p>Education on fish smoking technologies, campaign against smoking.</p>
<p>dfill site in Sierra Leone. There are two main dumpsites in the city Bormeh: King Tom brook; two in Bo, one in Kenema and one in Makeni. Interestingly they are all called dumpsites are characterised by indiscriminate dumping of waste by city council skip seholds. It was reported that an average of five trips is made by the trucks (19 y in Freetown, three trips in the other cities. Sewage is openly deposited on top of the to help put out accidental fires.</p>	<p>Construction of sanitary landfills</p>
<p>of the above mentioned processes are normally just discarded. They usually find water bodies through surface runoff, or in the soil through leaching. There have extensive gara tie-dying activities; such activities are normally characterised by the ed chemicals for bleaching purposes. These chemicals find their way into water or the air. There is the Forest Industries Corporation in Kenema district; insecticides ts are normally applied to the processed timbers. The SRL mine sites have two moves a great portion of the earth, there by creating ponds; the bauxite mines also t portion of the earth. There used to be one bauxite and iron ore mine in the north.</p>	<p>Environment departments to be established/strengthened for data base management in order to enhance compliance to the prevention and control of pollutant release.</p>

### 2.3.3.3 PCDD/PCDF Source quantification

The annual releases for all vectors from a source or a source category are calculated as follows:

Source strength (UPOPs emission per year) = Emission Factor x Activity Rate

The PCDD/PCDF emission is expressed in grams TEQ per year.

Activity Rate = the amount of feed material processed or product produced in tonnes or litres per year by each of the emission factors

Each emission factor is the amount of PCDD/PCDF (in  $\mu\text{g I-TEQ}$ ) that is released to any of the five vectors per unit of feed material processed or product produced (e.g., tonnes or litres). Default emission factors represent average PCDD/PCDF emissions for each class within each subcategory.

**Table 9: Annual UPOPs emissions in Sierra Leone**

No.	Main Source Categories	Annual Releases (g TEQ/a)			
		Air	Water	Land	Residue
1	Waste Incineration	2.0			0.01
2	Ferrous and Non-Ferrous Metal Production				
3	Power Generation and Heating	6.88			
4	Mineral Production	0.274			
5	Transport	0.008			
6	Uncontrolled Combustion Processes	637		8.00	588
7	Production and Use of Chemicals and Consumer Goods (incl. gas flaring from oil production)				
8.	Miscellaneous	0.00018			
9.	Disposal/Landfill		0.09		
10	Potential Hot Spots	-	-	-	-
1-9	Total	646.16	0.09	8.00	588.01

### 2.3.3.4 Target groups

It was found that almost every individual is unknowingly a culprit in generating dioxins and furans. Categories of areas serving as principal sources include formal and informal industries, transporters of sewage sludge, producers of household and municipal waste, wood and charcoal suppliers, suppliers and users of fuel, transport owners, farmers/gardeners, technicians, etc.

Settlements close to or around dumpsites are the principal recipients of the pollutants. Cases of skin itches, skin rash, and other complications were reported. Households, farmers/gardeners, pedestrians, workers in factories, etc., are also susceptible to the pollutants.

### 2.3.3.5 The status of UPOPS management in the country

No formal management scheme was discovered in the entire country. However, recycling and reuse of some specific waste materials likely to generate the by-products have been practiced on a very



small scale over a long period of time. The most common is the recycling of aluminium and non-aluminium metals into various products including agricultural tools, construction materials and household utensils. Local shoe makers called “Karankays” have also been involved in the recycling of various animal skin wastes, cardboard, and tyres to make different products ranging from shoes, wallets, bags, bracelets, etc. Only a very small amount of office papers and plastic bags have been reused for packaging, wrapping, etc. Glass (flat glass and bottles) has also been reused in very small quantities on wall fences to prevent easy access by thieves. A very small fraction of organic waste is converted to compost and used in backyard gardens and small vegetable fields.

The concept of UPOPs management in Sierra Leone is a very new issue. This had a negative effect on the data collection process, as respondents either quickly deviated from the focus or were jittery in providing relevant information for fear of being prosecuted. Compilation of an inventory of UPOPs requires ample time and resources. This work was greatly limited by lack of time and resources. Travelling up-country is usually complicated by uncontrolled fluctuations of fees and other inconveniences. Officials in charge of information sought were hardly at their offices. It had to cost more for obtaining communication, further travelling and extension of time beyond the planned.

### 2.3.3.6 Conclusion and recommendations for UPOPs management

Table 10 details the conclusions drawn from the objectives and recommended actions for future policy formulation and implementation.

**Table 10: Conclusions drawn from the UPOPs inventory study**

Objective	Conclusion	Recommendations	
		Policy	Operations
To identify all the sources and assess the current situation of PCDD/PCDF in the Sierra Leone environment	Most of the sources outlined in the UNEP Standardised Toolkit were identified The most prominent of all were uncontrolled combustion processes in homes, dumpsites, farms/gardens, etc.	Review of the environmental policy to include management of UPOPs	Set up a department of environmental pollution prevention and control Partner with regional and global institutions, enhance furtherance of the recommendations of this report
To estimate the quantity of the various sources as a first estimate of the magnitude of their release in Sierra Leone	Emission factors as prescribed in the UNEP Standardised Toolkit were used to calculate the estimated quantity of UPOPs released	The policy could prescribe standards and enforcement strategies to help mitigate the growing levels of the pollutants	Advocate for the enactment of the policy Partner with law enforcement agencies to enact the policy
To evaluate the impact of the emissions on environment and human health, using the UNEP Standardised Toolkit	No prevention and control mechanism was identified It is very common to see Sierra Leoneans with persistent health problems yet no disease diagnosed	The inclusion of standards in the policy will help prevent people from contracting diseases relating to UPOPs	Investigate from time to time the impact of the policy with regard to the health status of citizens



### 2.3.4 Contaminated sites

#### *Summary*

The Stockholm Convention on Persistent Organic Pollutants is among the key Multilateral Environmental Agreements (MEAs) that the international community is advocating for every national government to implement. Sierra Leone acceded to this convention on 26 September 2003. The first inception workshop on the National Implementation Plan was held at the Mamba Point, Wilberforce Village, Freetown on 5 December 2006 followed by a training session on POPs Inventory from 6 – 8 December 2006. The Survey on Contaminated Sites was one of the relevant inventory tasks that emerged from the final deliberations. The work programme consisted of three main phases.

Polychlorinated biphenyls (PCBs), Polychlorinated dibenzo-*para*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) are the two main categories of POPs chemicals identified in the Western Area and its environs (Phase 1) as well as the Southern and Eastern Districts (Phase 2) of Moyamba, Bo, Kenema and Kailahun. Although trade in pesticides was observed in Moyamba and Kenema, no sites contaminated with POPs pesticides have been identified in the three regions.

Two thermal power stations in the Western Area and Southern District Town of Bo, several leaking transformer sites and one privately owned used oil refinery have been identified with potential PCB contamination. Four transformer sites with severe leakages in the Western Area; four each in the Southern District Town of Bo and Eastern District Town of Kenema have been identified while those found in the Moyamba Town had very minor leakages and were also out of use.

Two official municipal dumpsites, Burmeh and Graville Brook, and two healthcare (hospital and pharmaceutical) waste disposal sites have been identified in the Western Area, while one illegal dumpsite was also identified at George Brook along the Jomo Kenyatta Highway in Freetown. These sites together pose serious health and environmental threats in the communities where they are located. About one official municipal waste disposal site in each of the District Headquarter Towns of Moyamba, Bo, Kenema and Kailahun were identified. Whereas these official sites were completely removed from areas of settlement in these towns, one site each in Bo and Kailahun was found situated within densely populated settlements around Mahei Boima Road in Bo and in Panguma Section in Kailahun. These sites require immediate remediation in order to minimise the acute health and environmental threats they pose to the communities.

In the three regions, medical (hospital) and pharmaceutical wastes are usually collected and disposed of by open burning at sites located within the hospital compounds. The close proximities of these sites to wards, human settlements and easy accessibility to scavengers including animals were serious health matters to be worried about. In Kailahun, for example, the hospital waste disposal site was very close to two primary schools with children aged between 5 and 12 years.

High resolution digital photos and Global Positioning System (GPS) recordings of the sites in UTM were taken of every site identified to be contaminated with POPs chemicals. Garmin's GPS 60 was used to record the coordinates of the positions of the sites.

#### *Definitions*

The Contaminated Sites Management Working Group (CSMWG), an interdepartmental committee of the Federal Government of Canada, established under the auspices of the Federal Committee on Environmental Management Systems (FCEMS), has defined:



*Contaminant:* any physical, chemical, biological or radiological substance in air, soil or water that has an adverse effect; any chemical substance whose concentration exceeds background concentrations or which is not naturally occurring in the environment

*Contaminated Site:* a site at which substances occur at concentrations: (1) above background levels and pose or are likely to pose an immediate or long-term hazard to human health or the environment, or (2) exceeding levels specified in policies and regulations

*Exposure:* the contact between a contaminant and an individual or population

*Exposure Pathway:* the route by which a receptor comes into contact with a contaminant; exposure pathways include ingestion, dermal absorption or inhalation

*Groundwater:* all subsurface water that occurs beneath the water table in rocks and geologic formations that are fully saturated

*Hazard:* the adverse impact on health or property which results from the presence of or exposure to a substance; the significance of the adverse effect depends on the nature and severity of the hazard and the degree to which the effect is reversible

*Human Health Assessment:* the process of defining and quantifying risks and determining the acceptability of those risks to humans

*Monitoring:* observing the change in geophysical, hydrogeological or geochemical measurement with time

*Pathway:* the route along which a chemical substance or hazardous material moves in the environment

*Receptor:* the persons or organisms, including plants, subjected to chemical exposure

*Remediation:* the improvement of a contaminated site to prevent, minimise or mitigate damage to human health or the environment; remediation involves the development and application of a planned approach that removes, destroys, contains or otherwise reduces the availability of contaminants to receptors of concern

*Risk Assessment:* the scientific examination of the nature and magnitude of risks to define the effects on both human and other receptors of the exposure to contaminants

*Remediation Criteria:* numerical limits or narratives

*Surface Water:* natural water bodies, such as rivers, streams, brooks and lakes, as well as artificial water courses, such as irrigation, industrial and navigational canals, in direct contact with the atmosphere

*Water Table:* the upper limit of the saturated zone; it is measured by installing wells that extend a few feet into the saturated zone and then recording the water level in those wells

#### **2.3.4.1 Introduction**

Contaminated sites are typically associated with commercial, industrial and waste disposal activities and commonly result from improper chemical storage practices; spillages; leakages and inappropriate waste disposal methods. Some contaminated or potentially contaminated sites are





obvious, such as sanitary landfills, while others may be innocuous, with the potential for hidden underground contamination.

The main objectives of the survey were:

- 1) To take inventories of sites contaminated with POPs chemicals;
- 2) To make assessments of the health and environmental impacts; and
- 3) To make recommendations for risk management and remediation. Human health and environmental risk assessment was a main focus of the inventory. This involved identifying the contaminants of concern, POPs chemicals in this case; identifying potential receptors; determining potential exposure pathways; and estimating the level of risks based on the pathways.

#### **2.3.4.2 Methodology**

The survey considered the 3 categories of POPs chemicals with potential of causing contamination – POPs pesticides, PCBs and PCB-contaminated lubricants and oils, and UPOPs (mainly polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs))

There are several different ways by which potentially contaminated sites may be identified including the following:

- Previous reports, e.g., consultant studies, annual reports, etc.
- Internal environmental program reports
- Off-site impacts
- Complaints by residents living within the environment or locality
- Similarities to other known contaminated sites
- Ocular and olfactory evidence of previous leakages, spillages, or discharges

The methodology used by the Team for acquiring information from suspected contaminated sites consisted mainly of literature reviews; interviews with authorities (i.e. directors, managers, etc.) and other informed persons, and a site visit or walk through the site.

The survey was planned to cover the entire country starting in the Western Area and its environs and moving outwards into the interior North, South and East. The 3 phases of the inventory carefully planned to fit the release of funds (30%, 40% and 30%), are as follows:

- PHASE 1 Greater Freetown and its environs
- PHASE 2 Eastern and Southern Districts
- PHASE 3 Northern Districts

The level of contamination varies from site to site; therefore priority criteria based on classification of materials disposed of on the site, proximity to sensitive receptors such as humans, animals and plants, water resources, settlements/schools/habitats, etc. were adopted.

The Initial Testing Programme, otherwise known as the Phase II Environmental Site Assessment, was adopted by the Team and had helped in planning and provision of valuable site information including the site description, nature and location of the contaminants, potential pathways for contaminant migration, the location of nearby sensitive receptors, and the potential for direct human exposure to these contaminants.



The team has successfully visited, inspected and taken inventories of 15 sites in the Western Area and its environs. 4 of these sites were void of POPs contamination, while 5 were contaminated with PCBs and 5 with PCDDs and PCDFs mainly. A wide variety of chemicals consisting mainly of organic compounds, pharmaceuticals, lubricants, paints and other obsolete chemicals were discovered in the customs warehouses of the Queen Elizabeth II Quay. Open burning of domestic, commercial, industrial and healthcare (hospital and pharmaceutical) wastes on the one hand and workplace exposures on the other, present a major health and environmental hazard in the Greater Freetown Area.

In the Southern Districts, the Team visited the towns of Bo and Moyamba. In Bo the Government Hospital and two municipal dumpsites were found to be generating PCDDs and PCDFs from open burning of these wastes. The Bo Power Station and 9 sub-stations (transformer sites) were inspected; the Power Station was found to be heavily contaminated with PCBs, 4 transformer sites had minor leakages while the other 5 showed no signs of leakages. In Moyamba Town, only one site, i.e. the main municipal disposal site, was found to be generating PCDDs and PCDF emissions. There was no PCB contamination arising from discharge of waste oils including lubricants from the power station. Minor leakages were observed from the only two transformers within the township which are presently out of use.

The headquarter towns Kenema and Kailahun in the Eastern Districts were also visited. In Kenema Town, the Government Hospital had a waste disposal site located within the hospital compound remote from wards and residential areas around the compound. PCDDs and PCDFs are obviously generated by burning of the hospital wastes from this site as well as from the central municipal waste disposal site at Gbendellu. Severe leakages were observed from 4 transformers within the township suspected of containing PCBs. In Kailahun town, only one active municipal waste disposal site was identified while the hospital, like many others, relies mainly on open burning of their wastes within the hospital compound.

#### ***2.3.4.3 Institutional and Regulatory Framework***

The responsible key institutions in the public and private sectors have limited capacity to manage contaminated sites in terms of administrative arrangements, technical support including equipment, waste treatment facilities and skilled human resources. Furthermore, the capacity to coordinate efforts among different institutions, even at government level, is either weak or largely non-existent.

The management of contaminated sites should involve various stakeholders such as government departments and agencies, non-governmental organisations (NGOs), research institutions, law enforcers, importers of POPs chemicals, transporters, handlers, and users. The concept of contaminated sites is, however, new in Sierra Leone and there is therefore a necessity for the Government to make provisions for its inclusion into our environmental protection, public health, local government, trade (including imports and exports of dual-use chemicals), labour and industrial laws and policies for possible enforcement.

#### ***2.3.4.4 Sites contaminated with POPs***

##### ***2.3.4.4.1 Western Area and environs***

Sites contaminated with polychlorinated biphenyls (PCBs) are characterised by spillages and leakages of oils from thermal electrical plants and units (transformers, capacitors and switch gears) that are suspected to contain PCBs. The National Power Authority's (NPA) Thermal Power Station at Kingtom, for example, shows a remarkable degree of spillages and leakages of diesel and various lubricant oils (see attached list) from the different ageing plants – Sulzer 4 & 5 (1978), Mitsubishi 6



(1995), Caterpillars (2000) and Mirrlees (2001), in addition to the containment of used oil in open concrete storage tanks. Being industrial in nature, these lubricants may contain PCBs. Also the two working transformers situated inside NPA compounds at Kingtom and Falcon Bridge were observed to be leaking and the type of dielectric coolant used, ONAN, suspected to contain PCBs needs to be verified. Two leaking transformers were also found at the basement of the middle-west wing of Youyi Building compound, Brookfields.

The Chinese owned used oil refinery situated at Rokel uses a very primitive method of extracting diesel from used oil obtained from the NPA Thermal Power Station in Freetown and the Bo Thermal Power Station (BKPS). The operation site is characterised by massive spillages and discharges of used and waste oils from the partially closed storage tank and boiler (sludge) respectively. Uncontrolled discharges of black oil are common throughout the premise area.

Sites contaminated with PCDDs and PCDFs are common within the Greater Freetown Area and its environs. There are 2 official landfill sites under the direct control of the Freetown City Council, one at the west-end in Kingtom called Burmeh and the other at the east-end called Granville Brook. Municipal waste is currently managed by the GTZ Clean Salone Project through the Freetown Waste Management System (FWMS) in the Ministry of Health and Sanitation. Both sites are characterised by uncontrolled burning of non-segregated wastes from industrial, commercial, domestic, and healthcare (hospital and pharmaceutical) sources giving rise to the generation of PCDDs and PCDFs. On-site evidence shows that Burmeh is also used as a disposal site for untreated sewage collected from septic tanks around the Freetown Municipality. The raw sewage runs directly into the nearby lagoon.

Wastes generated from the healthcare sector including the Connaught Hospital and the Government Central Medical Stores were found to be poorly managed. Waste disposal at the Connaught Hospital involves dumping and burning of all categories of waste collected from the hospital at a site situated within the hospital compound and very close to the wards and the sea. There is, however, an incinerator, a small size though, that ceased to work shortly after being commissioned. The open burning of these wastes (mainly infectious, pathological, chemicals and pharmaceuticals, sharps, etc.) is an adverse health hazard for workers, patients, students, visitors and residents around the hospital.



Figure 9: Medical waste

Expired and confiscated drugs (banned, counterfeit, deteriorated, sub-standard, smuggled and abandoned) are destroyed by burning in an open pit at the Government Central Medical Stores compound under the supervision of the Pharmacy Board of Sierra Leone. The open burning of these drugs often results in the release of offensive odours into the surrounding environment, much to the discomfort of the residents of the New England and the Brookfields communities including workers



and inmates at the Special Court of Sierra Leone. The burning may also lead to the production of PCDDs and PCDFs.

Open burning of domestic, commercial, industrial and healthcare (hospital and pharmaceutical) wastes on the one hand and workplace exposures on the other, present a major health and environmental hazard in the Greater Freetown Area.

#### *2.3.4.4.2 Southern districts*

In Moyamba, the hospital wastes were found to be managed separately from the municipal wastes with some amount of segregation carried out on former. Syringes, needles, other sharps are usually deposited into safety boxes and burnt down when full or at the end of every day and only ash is deposited into a pit located within the hospital compound. Body fluids including blood, body parts, afterbirths, etc. are disposed of into an old toilet (latrine) pit, also located within the hospital compound. The depth of this pit was, however, not known to ascertain the possible health impact on the groundwater. The District Environmental Health Superintendent attached to the Moyamba Government Hospital supervises the management of both hospital and municipal wastes in the township. There is only one 7-ton open refuse truck in the township which collects hospital wastes as well as domestic and commercial wastes from 52 collection points located in various places in the township, and takes them to the final disposal site at Mende Gelema, about 3 miles away from the central business area of Moyamba. Though burning was as usual at the site, the potential health impact was judged by the Team to be very minimal, since the site is far removed from settlements and schools and the Moyamba-Freetown road that goes through Bradford and Mabang Bridge. Furthermore, there was little or no direct exposure of humans and animals; no water bodies within the vicinity and no scavengers were seen on site. The former waste disposal site had been relocated to this site because of its close proximity to the Moyamba Junction Highway, wherein pedestrians, drivers and passengers were directly exposed to emissions from the site, while scavengers also had easy access to the site.

In Bo, the Bo-Kenema Power Service (BKPS), the Bo Government Hospital and Bo City Council (Local Government) were visited and inventories taken of the Bo Power Station, Hospital and the Municipal waste disposal sites.

#### *Bo-Kenema Power Service*

The Bo-Kenema Power Service (BKPS) provides power to the Bo and Kenema Townships from three thermal power plants, MAN B & W, located at Tikonko Road, Bo and from the hydroelectric power generated from the Gomma, near Dodo. The three MAN B & W thermal plants were commissioned in 1987 and produce a total of 5 megawatts of electricity (two thermal plants each of 2 megawatts and one of 1 megawatt) while the hydroelectric power plant generates 4.0 megawatts of electricity with a possibility of increasing this capacity to 6.0 megawatts after the current rehabilitation (May 2007). The thermal plants produce electricity for the two townships for the dry period from December to May while the hydroelectric plant produces power for the wet period from June to November within the year. The thermal plants use heavy fuel oils (HFO), marine fuel (Diesel), petrol, gear oil, and lubricants (Rimula X and Argina T40). Turbine T40 oil is used to top-up about 14 transformers located in various places within the Bo Township. Management of waste oils from these thermal plants and transformers, believed to contain or being contaminated with PCBs, is a major problem from the BKPS, Bo at Tikonko Road. Waste oils are collected in a storage tank located within the Bo Power Station and are released directly, when full to capacity, into the drainage system. The drain runs across the Tikonko road and through the swamps around Fofana Street to far remote areas within the township. Vulnerable age groups like children from age 5 and below, the aged (60+), birds and other animals are all directly exposed to the waste oils. Complaints



from farmers arising from contamination of their swamps used for agriculture are common. Scavenging for waste oils is also a common practice within the communities. While surface waters are contaminated during floods, there is also a high possibility of contamination of groundwater sources. Tap water is seldom available; thus the Bo Town Community relies heavily on water collected from wells located within its compounds. There is therefore an urgent need to monitor the quality of water from these wells for PCBs especially during the rains when floods are common and groundwater levels are expected to rise.

#### *Bo Governmental Hospital*

The hospital generates domestic (from kitchens and wards), administrative, chemical and pathological (labs), and pharmaceutical wastes including sharps. Like many others, these wastes are not segregated and are destroyed by burning at a site located within the hospital compound, only a few meters away from Ward #8 and the children's ward under 5 Clinic.

The hospital patients as well as workers are all exposed to the health hazard of burning the wastes. At the time of this inventory, there were about 160 patients admitted in 11 wards. There were also 187 government employees, 45 volunteers and 7 Cuban expatriate doctors. To express their dissatisfaction about the crude method of destroying the hospital wastes, the Cuban doctors, the Team was told, always left the hospital as soon as the burning started. For this reason, the time of burning was changed from 2:00 pm to 5:00 pm. No sorting of wastes takes place.

Two incinerators were found in the hospital compound. The old incinerator built by the MSF is no longer in use, while the recently constructed incinerator is too small for any meaningful destruction purpose. Close to the new incinerator was an underground pit meant for the disposal of sharps and body parts. There was, however, no indication of it being used.

#### *Bo Town Council – Municipal Waste Management*

The Bo City Council is responsible for the management of the domestic, commercial and industrial wastes generated within the township. The Bo City Council currently has 3 compactor vehicles that collect waste from the market locations, parks, including other collection points and take to the new waste disposal site located at Manjama, 5 miles away from the central business area in Bo Town. The Manjama waste disposal site has an area of about 8 acres. There was no construction at site for the refuse disposal and only partial segregation takes place – bottles, tins and metals.

Raw sewage collected from septic tanks within the township is also taken and disposed of in two well constructed concrete tanks located side by side. Though the disposal site is well removed from the township, the disposal actually takes place very close to the Bo-Makeni road which may expose passengers as well as pedestrians to fumes from the site. A farm has also been established very close to the site. There was only one scavenger seen on site at the time of the inventory taking. There was no surface water body within the immediate vicinity and no access for animals. Health and environmental impacts are therefore minimal.





**Figure 10: Dumpsite fire**

Unlike the official Mangama dumpsite, the Kola Store dumpsite located at Mahei Boima Road was not only an eyesore, but also a serious health and environmental hazard. It is located within a settlement and at a site that was originally meant for the development of a motor park. It is very close to a swamp and, having been there for more than 10 years, may likely have a potential of contaminating or polluting the groundwater system. Since the dumpsite is in a market area, a huge population of children, youths and the aged are all directly exposed to the health hazard resulting from burning. Scavenging by children aged 5 – 12 years was clearly evident. These children carry garbage to the site and spend their good times searching or using the site as toilet.

#### *2.3.4.4.3 Eastern Districts*

Kenema and Kailahun Towns were visited and inventories taken from the Bo-Kenema Power Service (BKPS), Kenema; the Kenema Government Hospital, and the Kenema City Council (Local Government) waste disposal sites.

##### *Bo – Kenema Power Service, Kenema*

The Kenema Power Station is currently being used mainly to distribute electricity generated from the hydropower plant in the rainy season and the thermal power plants in Bo.

There are about 15 transformers in and around the township of Kenema. About 11 were inspected; four of these sites were observed with very minor leakages, while another 4 had very serious or massive leakages. The latter 4 include the transformers located at Dama Road, SLPMB Compound; Kenema Air Field, Eastern Polytechnic (TIK) and the Kenema Reservation Area. Although there were no water bodies in the immediate vicinities, the situations may deteriorate into contamination or pollution of groundwater in the long term if immediate actions are not taken now. People however live and trade within some of these areas. The Eastern Polytechnic at Technical Institute, Kenema (TIK) was clearly identified as one such site, being only few meters away from the site. There is also a likelihood of flooding within these areas.

##### *Kenema Government Hospital*

The Kenema Government Hospital generates administrative, domestic (from kitchen and wards), pathological, chemical (laboratory) and pharmaceutical wastes including sharps. The hospital waste management is under the direct supervision of the Hospital Medical Superintendent, assisted by the Kenema District Environmental Health Superintendent attached to the Kenema City Council.



Wastes collected from the hospital are never sorted before being destroyed by burning in an open shallow pit; burning takes place every two weeks at a site located in a remote part of the hospital. Two incinerators were found at the disposal site, an old one which was constructed by the Hospital Board while the other, a new one, was constructed with the help of the International Committee of the Red Cross (ICRC).

Open burning seems to be the preferred method of destruction; the two incinerators found at the site were by all indications seldom used. There have been no complaints from residents living around the hospital.

#### *Kenema District (Town) Council – Waste Management*

The Kenema District (Town) Council is responsible for the management of the domestic, commercial and industrial wastes generated within the township. The Kenema Town Council has 3 trucks (2 compactors and 1 tipper) that collect wastes mainly from the markets, district office areas, parks, including other collection points and take them to the Gbendellu disposal site about 3 miles away from the central business area in Kenema Town. The Gbendellu waste disposal site has an area of about 5 acres. There was no construction at site for refuse disposal and only partial segregation takes place – bottles, tins and metals. Though the disposal site is remote from the township, the disposal actually takes place very close to the Kenema-Zimmi Highway which may expose passengers as well as pedestrians to fumes from the site. There was very minimal burning (smoke) and no scavenger seen on site at the time of inventory taking. Also, there was no surface water body within the immediate vicinity and no fence.

#### *Kailahun Government Hospital*

The Kailahun Government Hospital generates administrative, domestic (from kitchen and wards), pathological and chemical (laboratory) and pharmaceutical wastes including sharps. The hospital waste management is directly supervised by the only doctor in the hospital.

Wastes collected from the hospital are never sorted before being destroyed by burning in an open shallow pit located very close to the wards and to two primary schools; burning takes place whenever there is sufficient waste at site. There is no incinerator at the disposal (destruction) site.

#### *Kailahun District (Town) Council – Waste Management*

The Kailahun District Council is responsible for the management of the domestic and commercial wastes generated within the township. The waste management is coordinated by the District Councilor and Secretary, both of Kailahun Ward 1. There was no transport facility to transfer garbage collected from the Kailahun market and other places to the new dumpsite, about 3 miles away from the central business area. Consequently, waste disposal still takes place within the town. Two dumpsites were visited; one at the market, now abandoned, and the other situated in Panguma Section. The sanitary labourers collect domestic and commercial wastes from the market places and take them to the dumpsite in wheelbarrows. Burning of waste was common and seems to create a very unhealthy atmosphere for residents of the Panguma Section. The site has been in use over 10 years and is now a huge hill in that part of the town.

The site is located within a densely populated community and close to a swamp and surrounding water wells. Scavenging is mainly done by the labourers and several local chickens. The health and environmental impacts of this site may be enormous and therefore require immediate remediation.



#### 2.3.4.4.4 Northern Districts

The third and final phase of the POPs inventory on contaminated sites was carried out in the Northern region. The team visited Makeni and Binkolo in the Bombali District and Port Loko and Lungi in the Port Loko District. Sectors of major concern included the Health, Agriculture, Energy and Power, District and City Councils for Municipal Waste Management.

In Makeni town, the team visited the Makeni Government Hospital at Mabenta road for PCDDs and PCDFs, District Agriculture Office for pesticides, the Makeni Power Station (NPA) at Loya Street for PCB wastes, the District and Makeni City Councils for Municipal Waste Management, etc.

##### *Makeni Government Hospital*

The hospital generates mainly domestic (kitchen), laboratory, pathological, chemical and pharmaceutical, administrative and other wastes, collected by the portals and disposed of in an open underground cemented pit located within the hospital compound. The waste management involves bulk collection (no sorting or segregation) of all hospital wastes and burning inside the underground pit. The burning, the team was told, is usually done in the evenings when most of the hospital staff has gone home. However, there is a serious health hazard resulting from the release of emissions into a densely populated community living around the hospital including a high population also of traders around the hospital. The waste disposal site was also noted to be very close to a female ward in the hospital.

##### *Makeni Power Station (NPA)*

The Makeni Power House, which formerly had 6 thermal generators, now has only one 900,000 kW caterpillar generator. It had not generated power in the past 2½ years. There was no PCB waste and therefore no contamination of the site. All transformers have been removed and transported to the Transmission and Distribution Head Office at Falcon Bridge in Freetown.

##### *District Agriculture Office, Makeni*

Common insecticides used include malathion, an insecticide for protection of vegetables from pests, phostoxin, furadan and cocotin, used as fumicide for the protection of cereals in storage against weevils.

The stores were occupied predominantly by organic fertilisers, obtained as processed by-products of palm oil and very few quantities of malathion, phostoxin, and furadan. The workers lacked protective clothing. No contamination was observed involving any of these pesticides.

Illicit trade in pesticides was also reported involving various insecticides coming from a market called Bamoi-Lumar in the Kambia District. A possible health hazard, however, results from misuse of some of the chemicals especially the use of cocotin in fishing and the sale to and consumption of the poisoned fish by the general public. Common symptoms of illness include upset stomach resulting in severe vomiting and sometimes death if immediate action is not taken.

##### *Makeni District and City Councils – Municipal Waste Management*

Municipal waste is managed in Makeni by the Makeni City Council. There are about 5 transit collection points strategically located within the township and only one compactor truck for the whole town. The waste management involves bulk collection with very little segregation (sorting) of the materials. The truck collects the wastes from the various points in the township and transports them to the disposal site(s) on the Makeni-Magburaka Highway. Final disposal is done





indiscriminately along the sides of the highway.

In the rainy season, burning of the wastes is less common, whereas in the dry season, it was reported, it is a common practice. Health hazards resulting from emissions of PCDDs and PCDFs were observed to be very minimal since the final disposal sites are 3 - 4 miles away from the central business areas in Makeni town. There was, however, a health concern for the small isolated settlements along the road, e.g., Rogbonko, Mabanta, etc.

Other health hazards reported involved the burning of sawdust and all related wastes from carpentry workshops during the dry season and of municipal wastes dumped in cemeteries, e.g., Kabala Road Cemetery.

In Port Loko the inventory team visited the Port Loko Government Hospital at Agriculture Road, old Port Loko, for PCDDs and PCDFs, the District Agriculture Office in old Port Loko for pesticides, the Port Loko Power Station (NPA) in old Port Loko for PCB wastes, the District and Port Loko Town Councils for Municipal Waste Management, etc.

#### *Port Loko Government Hospital*

The hospital waste comprises mainly domestic (kitchen), pathological, laboratory, chemical, pharmaceutical and administrative wastes, being managed by the District Health Superintendent and the Health Superintendent in the Port Loko hospital. They also assist the Port Loko Town Council in the management of municipal wastes. The health superintendents conducted a waste management workshop in the year 2004 which involved peripheral Health Units (PHUs), staff from the Mabaseneh, Lunsar, Lungi, etc. hospitals.

In 2004 when the management of hospital wastes became a very serious concern of the central government, a 6-day waste management workshop was conducted involving the hospital staffs from Mabaseneh, Lunsar, Lungi, etc. and all in-charges of the peripheral health units (PHUs) in the Port Loko District. With the help of Chinese experts one incinerator was also constructed within the hospital compound for the safe disposal of wastes from the hospitals. Safety boxes for collection of used sharps during measles and polio campaigns were also provided. The contents of the safety boxes are burnt out in pits dug out in the hospital/clinic compounds, thereby posing a possible health threat resulting from emissions to residents living within the immediate neighbourhood. The incinerator was observed to have been out of use for a long time, possibly because the porters prefer the open pit system of disposal and burning of wastes to the incinerator. Supervision by the Health Superintendents had also been constrained because there are no incentives as planned out in the 2004 workshop and the following refresher training workshop in 2005. Furthermore, monitoring and supervision of the peripheral health units are also constrained because of lack of motor bikes, fuel supplies and maintenance costs.

#### *Port Loko Agriculture Office*

The 3 main insecticides used in the district are malathion (25% and 50%), furadan and PPF. Nine 20-foot containers were provided in their last project for storage of all pesticides including other hazardous chemicals. These containers are located about 300 - 400 meters away from the main office area. Two of them were in good state while the rest of the others either needed repairs or complete replacement. The storage facilities were all empty and no threats to human health and the environment were observed from previous storages.



Furadan and the 50% malathion, the team was told, had been misused by farmers and the general public in killing birds and bedbugs respectively. The health impacts of eating poisoned birds include upset stomach followed by vomiting.

However, lack of protective gears during pesticide use was considered a possible high health risk by both agricultural (crop) workers and farmers.

#### *Port Loko Power Station (NPA)*

The Port Loko Power House used to generate about 910 kW for the township in the early 1990s. The Power Station had not generated electricity in the past 8 years and therefore there were no spillages or leakages of PCB-contaminated oils or lubricants. All the thermal engines had been removed and transported to the Freetown Headquarter.

Four transformer sites were visited and none had transformer oil in them. Therefore there were no health and environmental impacts arising from the disposal of waste oil from the power station. There were also no health and environmental threats from the transformers.

#### *Port Loko Town (Old) – Municipal Waste Management*

The District Health Superintendent and the Health Superintendent assist the Port Loko Town Council in the management of municipal wastes. There are 6 transit collection points (TCPs) strategically located in different parts of the township. The residents in those communities deposit their household refuse in the small cement block houses over time while the labourers collect from these points in their wheelbarrows and omolankays (local wagons, usually driven by one or two people) and carry the wastes to one of the three final disposal sites located along the Kambia-Masiaka Road, Rosaar Road, and Malaska Road. The only active disposal site at the moment was the one located along the Masiaka-Kambia Highway, where the Council is carrying out landfilling of the excavated areas by the Civil Engineering Company (CEC) that was constructing the Masiakia-Kambia Highway.

Two of the final disposal sites were considered safe with no health or environmental threats because they were completely removed from residential areas, schools, market areas, village settlements, etc. The third site at back of Malaska road was identified as a landfill site (valley) very close to a water well serving the community. The use of site was immediate discontinued.

#### *Freetown International Airport, Lungi*

At the Freetown International Airport, Lungi, the team conducted a tour to the air freight (cargo) section, power (generator) houses, engineering sections (electrical and civil), and the waste management section. The airport was, on the whole, very clean except for one of the generator houses that had traces of black oil in the drainage system. It did not appear to be an urgent health or environmental threat but requires some attention. There was also an old transformer within the power house compound that had no label plate.



## 1 with POPs

Size (m <sup>2</sup> )	Owner	Responsible parties	Potential impacts	Public Concerns
7,315	Public	NPA	Pollution of the environment; workplace health hazard	Direct discharge of wastes into the sea
Point	Public	NPA	Pollution of the environment; workplace health hazard	Soil pollution of leaking transformer
Point	Private	Chinese-Sierra Leonean partnership	Contamination of surface water bodies and potential for underground water sources	Nuisance in the midst of a growing township; very unsightly; work place and public health hazards
Point	Public	Sierra Leone Police	Work place health hazard	Ecological hazard as discharge is directly into the sea
Point	Public	Sierra Leone Government	Workplace health hazard	Public health hazard
9,893	Public	Freetown City Council/FWMS	Land, water and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Ministry of Health and Sanitation	Land, water and air pollution	Offensive odours and potential of causing respiratory diseases
Point	Public	Ministry of Health and Sanitation	Land, water and air pollution	Offensive odours and potential of causing respiratory diseases
1,459	Public	Freetown City Council/FWMS	Land, water and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Unofficial (illegal)	Freetown City Council/FWMS	Land, water and air pollution	Offensive odours and potential of causing respiratory diseases

Location of Site	Size (m <sup>2</sup> )	Owner	Responsible parties	Potential impacts	Public Concerns
<b>SOUTHERN DISTRICT, BO – PCBs</b>					
Bo Power Station (BKPS) Compd.	Point	Public	NPA / BKPS	Surface waters, soil, and groundwater pollution	Sites contaminated are both unsightly and serious health and environmental hazards
Bennimix Sub-Station	Point	Public	NPA / BKPS	Possible soil pollution	Public health hazard
Kawusu Street Sub-Station, Sewa Road	Point	Public	NPA / BKPS	Possible soil pollution	Public health hazard
EUB Sub-Station	Point	Public	NPA / BKPS	Possible soil pollution	Public health hazard
Candy Mountain (Radio Link)	Point	Public	NPA / BKPS	Possible soil pollution	Public health hazard
<b>SOUTHERN DISTRICT, BO – UPOPs</b>					
Bo Government Hospital	Point	Public	Ministry of Health and Sanitation	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Kola Store Dumpsite, Bo	Point	Public	Bo City Council	Land, water and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Manjama (Main) Dumpsite, Bo	Point	Public	Bo City Council	Land and air pollution	Minimal public health and environmental hazards
<b>SOUTHERN DISTRICT, MOYAMBA – PCBs</b>					
NPA Moyamba, Siaka Stevens Street	Point	Public	NPA	Soil and air pollution	Minimal public health and environmental hazards
<b>SOUTHERN DISTRICT, MOYAMBA – UPOPs</b>					
Mende Gelema Dumpsite	Point	Public	Moyamba District Council	Land and air pollution	Minimal public health and environmental hazards
<b>EASTERN DISTRICTS, KENEMA - PCBs (Transformers)</b>					
Dama Road (SLPMB compd.)	Point	Public	NPA/BKPS	Soil and air pollution	Public health and environmental hazards
Eastern Polytechnic (TIK), Comberna Road	Point	Public	NPA/BKPS	Soil and air pollution	Public health and environmental hazards
Government Reservation Road	Point	Public	NPA/BKPS	Soil and air pollution	Public health and environmental hazards

Size (m <sup>2</sup> )	Owner	Responsible parties	Potential impacts	Public Concerns
Point	Public	NPA / BKPS	Soil and air pollution	Public health and environmental hazards
Point	Public	Kenema City Council	Land and air pollution	Minimal potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Ministry of Health and Sanitation	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Kailahun District Council	Land, water and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Ministry of Health and Sanitation	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Ministry of Health and Sanitation	Land and air pollution	Public health & environmental hazards
Point	Public	Bombali / Makeni City Councils	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Ministry of Health and Sanitation	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Ministry of Health and Sanitation	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.
Point	Public	Bombali / Makeni City Councils	Land and air pollution	Potential of causing respiratory diseases, outbreaks of epidemic diseases, etc.

### 2.3.4.5 Preliminary identification of priority sites

Three levels of priorities were identified for each class of POPs; the table below summarises these priorities:

**Table 12: Criteria setting for contaminated sites**

Type	Criteria	Priority
PCBs	Leaking equipment, spillages and discharges within working environment; very close to sensitive receptor(s), i.e. water bodies, people, etc.; action immediately required	1
	Leaking equipment or contaminated site; action likely required	2
	Contaminated site; action may be required	3
UPOPs	Contaminated site very close to water bodies and residential areas; action immediately required	1
	Contaminated site; close to water bodies and residential areas action likely required	2
	Contaminated site; action may be required	3
Pesticides	Very poor packaging and storage facilities, site close to sensitive receptors, i.e. water, people, etc; action immediately required	1
	Contaminated site; action likely required	2
	Contaminated site; action may be required	3



Table 7: Priority sites

Type	Site	Priority
PCBs	Kingtom Power Station	1
	Chinese owned used oil refinery	1
	Sierra Leone police garage	3
	Youyi Building, Freetown	2
	Falcon Bridge, Freetown	2
	Bo Power Station (BKPS) Compound	1
	Bennimix Sub-station, Bo	2
	Kawusu Street Sub-station, Sewa Road, Bo	2
	EUB Sub-Station, Bo	1
	Candy Mountain (Radio Link), Bo	2
	Dama Road (SLPMB compd.), Kenema	2
	Eastern Polytechnic (TIK), Combema Road	1
	Government Reservation Road, Kenema	1
	Kenema airfield	2
	NPA Moyamba	3
UPOPs	Burmeh landfill dump	1
	Government Central Medical Stores & Pharmacy Board of Sierra Leone	1
	Connaught Hospital	2
	Granville Brook, Kissy	1
	Bo Government Hospital	1
	Kola Store dumpsite, Bo	1
	Manjama (Main) dumpsite, Bo	3
	Mende Gelema dumpsite, Moyamba	3
	Gbendellu dumpsite, Kenema	3
	Kenema Government Hospital	2
	Panguma section dumpsite, Kailahun	1
	Kailahun Government Hospital	1
	Makeni Government Hospital	1
	Makeni-Magburaka Highway Disposal Sites	3
Port Loko Government Hospital	2	
Kambia-Guinea Highway Disposal Site	3	
PESTICIDES	No pesticides contaminated sites discovered yet	

#### 2.3.4.6 Current capacity and experience

There is a considerable decline in the current national capacity and experience relating to waste and contaminated sites management in the public as well as the private sectors of Sierra Leone. This



decline has affected and will continue to affect all aspects of the general infrastructure including the legal, institutional, administrative, technical, professional and even mid-level manpower development. While the decade long conflict has a major share of the blame, the inability of the national government, which relies heavily on donor funds to sustainably finance the development and implementation of sound integrated waste management policies and regulations, is another critical contributing factor. The development of integrated environmental and waste management policies is a way forward and should ensure the incorporation of present-day environmental principles such as Pollution Prevention, Polluter Pays Principle, Best Environmental Practices and Best Available Technology, Cleaner Production and Clean Technology, etc. into our domestic laws and regulations.

Sierra Leone will continue to see this fragmented system of waste management, sad to say though, and the lack of adequate waste management facilities, e.g., waste treatment facilities, modern incinerators suitable for hazardous wastes, etc. until adequate and sustainable financial and technical support is provided to responsible institutions. Further financial and technical supports are also required to provide scientific and technical equipment including professional training opportunities that will facilitate the acquisition of scientific data to help policy- and decision-makers. Health and environmental monitoring, research and development, etc. will also fall in their desired places including the preservation of environmental dignity and integrity.

#### *2.3.4.6.1 Assignment of responsibility and liability*

From the section on sites contaminated with POPs chemicals we see that ownerships and responsibilities are given to several institutions in the public and private sectors. These ownerships and responsibilities are usually given in the public sector by Acts of Parliament and in the private sector by agreements between a ministry, e.g., Ministry of Trade and Industry, Development and Economic Planning, Labour and Industrial Relations, Mineral Resources and/or Department of Environment and the Investor (Applicant) wishing to invest in establishment of companies, factories, enterprises, or any other form of business for expected compliance with certain rules and regulations. Lack of appropriate logistic requirements for effective monitoring over long periods of time can lead to situations where business entities may be left to operate on their own. Consequently, little or no attention is usually paid to the terms and conditions of the agreement they had signed before in an effort to maximise profits.

In the public sector, usually sufficient mandates or authority(ies) including financial and logistical supports are not given to the institutions with monitoring responsibilities to carry out their jobs as prescribed. Furthermore, there is hardly any forum where the institutions are required to give account of their activities as against certain benchmarks, if any that they indicate in their budget lines for a given fiscal year. Usually proposed budgets do not tally with actual amounts provided.

#### *2.3.4.6.2 Waste management facilities*

The main categories of municipal wastes so far identified include domestic, commercial, industrial, hospital (medical) and pharmaceutical, etc. Effective management facilities or strategies should be considered in light of the complete life cycle of wastes irrespective of the category to which they belong. Generally the life cycle of wastes consists of generation (production), collection, storage, transportation, treatment, recycling and reuse, and final disposal. Facilities for all these stages are limited in the Western Area as well as in the Southern and Eastern Districts of Sierra Leone. No sorting (segregation) takes place at point of production (source) because no facilities are provided. The waste management systems are mainly focused on “whole disposal” in which the different categories of wastes including hazardous wastes are collected and disposed of together at the same site.





To facilitate collection and transportation, there are transit collection points situated in key places. Very minimal segregation (sorting) involving removal of bottles, tins, scrap metals, etc. takes place at these transit points. In the Greater Freetown Area are 31 transit points, 51 in Moyamba, 27 in Bo, 22 in Kenema and 2 in Kailahun. Limited transport facilities are also available to transfer wastes from these transit points to the final disposal sites. In Freetown these were 11 trucks (9 compactors and 2 tippers); 4 trucks in Bo (3 compactors and 1 tipper), 3 trucks in Kenema (2 compactors and 1 truck (tipper) in Moyamba. There was none in Kailahun. Because of the limited transport facilities, therefore, only key areas in these townships are provided with transit collection points while the rest of the communities in remote (or disadvantaged) areas still use the common open burning method.

Hospital wastes are managed within the hospital compounds. Generally there were no appropriate disposal facilities for the wastes. Wastes from theatres, laboratories, wards, kitchens, etc. were handled and disposed of in the same place. Where incinerators existed, these were hardly used on a regular basis. Therefore open burning was the most common method of disposing of the wastes. Furthermore, there are currently no health standards required for the use of these incinerators.

Pharmaceutical wastes have no transit collection points; the producers are required to take their expired products (wastes) to the only available disposal site at Central Medical Stores, New England, Freetown. Confiscated pharmaceutical products including other drugs are usually taken to the site by police escorts.

Currently there are no collection and transport facilities for PCBs or PCB containing wastes from the power stations. Temporary storage facilities (tanks or open concrete tanks) were, however, available which would be considered inadequate during full time operations.

Waste treatment facilities were completely unavailable in the places visited and inspected to-date even though it is an essential component of waste management. Waste treatment minimises the health and environmental impacts by reducing the leachability and mobility of hazardous constituents. Common waste treatment techniques include composting (suitable for general organic wastes), and solidification, immobilisation and cementation for hazardous wastes.

Final disposal site facilities for municipal and industrial wastes are also limited. It was a common practice of depositing wastes on bare laterite soil with little or no site preparation. In Kailahun a concrete floor has been prepared for the disposal of their municipal wastes.

#### *2.3.4.6.3 Contaminated sites remediation capability*

Contaminated sites and all related issues are entirely new concepts in the policies and regulations in Sierra Leone. That is, both contaminated sites and remediation/risk management are nowhere addressed in the legal and policy documents of Sierra Leone. Therefore remediation capabilities for such sites are completely non-existent in the moment. However, listed below are some contaminated sites remediation technologies relevant to soil remediation:

- Bioremediation
- Air sparging
- Soil washing
- Low temperature thermal desorption
- Vapour extraction
- Air stripping



#### 2.3.4.6.4 *Environmental monitoring capability*

A comprehensive environmental monitoring program is essential to provide early warning of potential environmental releases of POPs chemicals; identify potential pathways for exposure to the public and the environment; help evaluate effectiveness of environmental remediation (e.g., of contaminated sites) and provision of data to demonstrate compliance with applicable regulations and policies.

Monitoring is usually done by sampling and analyzing the environmental media such as the air we breathe, the water (drinking, surface, ground water) we drink, the soil on which we plant our crops, sediments from streams, rivers including harbour areas and flora (plants) and fauna (animals). POPs chemicals (pesticides, PCBs, and dioxins and furans) are organic pollutants usually present in trace quantities (amounts) in these media, and therefore require very sensitive and high precision analytical equipment such as gas chromatography - mass spectrometry (GC-MS), high performance liquid chromatography (HPLC), and highly skilled and experienced personnel.

No scientific institution including the University of Sierra Leone has such analytical capability (equipment) at the moment because of its prohibitive cost and the cost of training. Few years ago only the Geological Survey of Sierra Leone had working atomic absorption spectrometers (AAS), while the Sierra Rutile Ltd had both an atomic absorption (AAS) and an X-ray fluorescence (XRF) spectrometer.

#### 2.3.4.6.5 *Health monitoring capability*

One of the findings of the POPs inventory on contaminated sites was the workplace exposure of employees (workers), who had little or no protective gear, to these chemicals. A responsible industrial operation involving hazardous substances like POPs chemicals must have an effective occupational safety and health (OSH) program to monitor workers for health effects that might result from unknown exposures to chemical or physical agents during normal operations or from accidental exposures during upset conditions.

The function of the occupational health and safety program therefore is to protect and promote the health and safety of employees and the public from hazards that may arise from industrial activities. The primary focus of the OSH is usually on the prevention of occupational illnesses and injuries, rather than on treatment, and on the prevention of occupationally related harm to the public and the environment.

The goal of employee health monitoring is to ensure that measures to protect the employees from workplace hazards are effective by carrying out medical surveillance programs for the early detection of adverse health effects.

Sierra Leone currently lacks the personnel to carry out workplace medical surveillance. In addition the key responsible institution, the Labour and Industrial Relations Ministry, completely lacks the capacity and capability to implement the labour policies relating to OSH in the country.

#### 2.3.4.6.6 *Research and development assets*

Policy development and decision making for sound environmental and waste management need to be supported by research. This should be directed to the development of appropriate technologies and methodologies to ensure sustainable resource use, impact management, and cleaner production.

Government support for both basic and applied scientific research necessary for better understanding



and for providing solutions to environmental and waste management problems are grossly inadequate and often given in bits and pieces. Therefore, institutions with a mandate or interest in research are unable to carry it out unless they get grants from their overseas partners or international donors.

Key areas needing research related to general environmental issues including wastes in Sierra Leone are:

- State of the environment
- Monitoring environmental quality
- Risk assessment/management
- Cleaner production
- Best practice
- Determining carrying capacity and sustainability indicators
- Sustainable resource use

Scientific research into these key areas is therefore not possible at the moment because government support is grossly inadequate to acquire basic and applied scientific research equipment. Professional training in the relevant fields is also extremely difficult to obtain. The highest academic institutions in Sierra Leone are no exceptions.

#### *2.3.4.6.7 Information management capacity*

In the section on waste management facilities it was noted that the complete life cycle of wastes consists mainly of generation (production), collection, storage, transportation, treatment, recycling and use, and final disposal.

Thus for the development of an efficient and effective information management system, all of these stages should be considered. However, because the general municipal and hazardous wastes are not sorted (segregated) preferably from source, waste specific information is often limited to total weight (in tonnes) for “whole disposal” rather than specifying the weights of the different categories of wastes.

The waste-specific information may include the following:

- Categorisation of the waste
- The mass/volume of waste generated, transported, and disposed of
- Chemical and patent names of waste categorised as hazardous
- Annual report system

The following are some requirements for an efficient information management capacity:

- Computer hardware
- Computer software
- Personnel
- Training of personnel

Developing a Waste Information System (WIS) is the best strategy for waste information



management at national, regional and at local levels; this strategy would, however, require well structured institutional and regulatory frameworks.

### **2.3.4.7 Findings, conclusions and recommendations**

#### **2.3.4.7.1 Findings**

The following are some of our findings from the inventory of contaminated sites as carried out in the Western Area (WA), Southern and Eastern Districts of Sierra Leone:

- a) Hospital (medical) and pharmaceutical wastes and/or products are commonly disposed of and destroyed by open burning at sites located within the hospital compounds and very close to residential areas. The health and environmental impacts are, of course, tremendous. Even where incinerators were found, open burning had preference. Moyamba and Kailahun were the only District Headquarter Towns that had no incinerators in the hospitals.
- b) Whereas the main municipal waste disposal sites are located within areas of settlements within the Western Area, the disposal sites in the Eastern and Southern Districts are located in areas that are far removed from central business areas with very minimal health and environmental impacts. The only exceptions, however, are the Kola Store dumpsite in Bo and the singular Panguma dumpsite in Kailahun. These sites are serious health and environmental hazards to the communities in which they are situated.
- c) Wastes containing or contaminated with PCBs from the National Power Authority (NPA) in Freetown (WA), including the massive discharges from at the Chinese owned used oil refinery at Rokel and the BKPS in Bo, are major health and environmental problems resulting from poor management strategies involving recycling and reuse.
- d) In the Southern District Town of Bo, the transformer units were either secured in houses or protected by fences and mounted on high concrete foundations that ensure minimal soil, surface water and groundwater pollution even where leakages may occur.
- e) Direct exposures to POPs chemicals were common at workplaces in the public as well as the private sectors. The health of workers was neither protected nor monitored in most (or all) places visited and inspected. This may be due to the fact that occupational health and safety mechanisms are poorly implemented in Sierra Leone as there are no trained labour related doctors to conduct medical surveillance.
- f) Waterways (channels, drainages, and streams) are often used as disposal sites. Open burning and localised flooding are common along these waterways in the dry and rainy seasons respectively.

#### **2.3.4.7.2 Conclusions**

The following are some conclusions from the inventory of contaminated sites as carried out in the Western Area (WA), Southern and Eastern Districts of Sierra Leone:

- a) Presently there are no appropriate National Environmental and Waste Management strategies to reflect sound management policies, regulations and standards. The result is therefore a fragmented, duplicating and overlapping national environmental and waste management system coupled with poor logistical and financial supports from the national government.
- b) The current capacities and capabilities relating to the legal, institutional, administrative, and



technical, and human resource potential are poorly developed. Consequently, there is a general lack of an effective and efficient institutional coordinating mechanism.

- c) Most public and private industries, if not all, including the small-and-medium scale enterprises have no occupational health and safety programs in place for their employees. Therefore the employees and the general public are often exposed to permanent workplace and environmental health hazards resulting from industry-related activities to which they are equally exposed.

#### 2.3.4.7.3 Recommendations

The following are some recommendations derived from the inventory of contaminated sites as carried out in the Western Area (WA), Southern and Eastern Districts of Sierra Leone:

- a) Waste management should be treated as a more important part of the National Environmental Management strategy. Therefore, a single well structured management mechanism that involves key sectors and all interested and affected stakeholders should be developed for Sierra Leone with a National Environment Authority as the Lead Agent. This authority, like the National Revenue Authority (NRA), must be represented in all sectors of the National Government.
- b) Hospital (medical), pharmaceutical and other hazardous wastes should definitely be treated with maximum safety by personnel trained and experienced in hazardous waste management. The final disposal sites for these hazardous wastes should be located in very remote areas, far from human settlements, water bodies, national parks for wildlife and national heritage sites with restricted access. There should also be efficient collection and transport facilities available on a daily basis to prevent accumulation that may possibly lead to negative health impacts.
- c) The current national capacities and capabilities are very poorly developed, a situation that can only be changed by seeking short-to-medium-term solutions that will address the capacity development needs of all key sectors/institutions relevant to the management of POPs chemicals. The legal institutions, both public and private, are critical here for the development of the appropriate laws, policies and regulations that will adequately address the incorporation of all present-day international approaches to environmental and waste management strategies and principles including the principles of total inclusion, transparency and accountability; pollution prevention; waste minimisation; waste information system; “polluter pays” principle; best available techniques (BAT); and best environmental practices (BEP), while regulating the activities of industries including the small-and-medium-scale enterprises. Capacity developments in the areas of waste and contaminated sites management are very crucial for sound human health and the environment. Human resource development will involve professional training in all relevant environmental disciplines such as environmental law, analytical environmental chemistry, environmental hydrogeology, environmental engineering, health and occupational safety, ecotoxicology, epidemiology, etc.
- d) Government support to research institutions must be improved to enable these institutions to acquire relevant scientific laboratory equipment and analytical instruments necessary for promotion of both basic and applied research to better understand the fate of POPs chemicals and their residues to which humans, wildlife and the environment are constantly being exposed to. Only scientific research can help us understand the state of the environment in which we live including the qualities of the air we breathe, the water and other beverages we drink, and the eggs, fish, meat, and all foodstuffs we eat on daily basis.



### **2.3.5 Awareness-raising , education and access to information**

#### ***Summary***

The persistent organic pollutant issue is relatively new to the people of Sierra Leone, despite awareness of other environmental topics. With this in mind, the National Sensitisation and Awareness-raising Team was charged with the responsibility of disseminating information on POPs, thus raising awareness in especially vulnerable groups such as women and children about the harmful effects of POPs on both the environment and human beings.

The perniciousness of POPs is becoming globally worrisome, catching the attention of most governments. This has led to the signing of the Stockholm Convention in 2001 by 151 governments. The commitment of Sierra Leone's Government to environmental issues and POPs in particular is manifest in the establishment of the National Commission on the Environment and Forestry (NaCEF). This Commission is determined to fulfil the requirements of the Stockholm Convention. Similarly, the Government has formulated environment related policies and other legal instruments including:

- National Environmental Policy, 1990
- Environment Protection Act, 2001
- National Environmental Act Plan (NEAP)
- Biodiversity Strategy and Action Plan

In the sensitisation exercise, the tools that exist were carefully looked at using different methodologies for their use in order to yield the desired result. Print and electronic media were extensively used in this exercise. Generally, the sensitisation was geared towards informing the nation about POPs and the Stockholm Convention's agenda of restricting production, use, release, storage of POPs and ultimately eliminating them. Thus, considering the seriousness and importance attached to this task, sensitisation was focused on a broader set of target groups including women, school children, communities around POPs identified sites, market women, religious groups, policy makers and the general public.

A greater percentage of this country's population lives in the rural area, and by their farming activity they are exposed to a series of environmental and health hazards as a result of domestic open burning of waste, fuel wood, charcoal, use of dynamite and pesticides for fishing. These people were especially targeted.

#### **2.3.5.1 Introduction**

The National Commission on Environment and Forestry (NaCEF) charged with the responsibility of championing environmental issues, in collaboration with UNIDO, organised a 3 day training programme on POPs for carefully selected participants 6 – 8 December 2006 in Freetown. Among the many important issues discussed was drafting the NIP. It was agreed that 5 task teams be formed to be responsible for different activities that will feed into the NIP. One of the teams was the National Sensitisation and Awareness-raising Team charged with the responsibility of educating the people on the twelve POPs and their effects on humans and the environment. Man's interaction at various levels with many chemicals from production to disposal involving the ocean, air, soil, plant and animals has resulted in environmental and health hazards. Industrialised communities are affected as well as poor farmers, who still practice the slash and burn method. It is estimated that 95% of this country's population is dependent on firewood, while 80% of the energy used is derived



from biomass. All of these take their toll on flora and fauna and especially on women and children, who are identified as the most affected.

### **2.3.5.2 Objectives**

The strategic goal is to inform the people of Sierra Leone about the Stockholm Convention and its relevance for their country.

Immediate and development objectives are changing behaviour by promulgating the dangers and indicating the sources of POPs, to discourage practices which generate POPs and to influence policy makers to enact and enforce legislation banning production, importation and storage of POPs over time. These objectives should be supported by broadcasting presentations on POPs sources and hazards on television.

### **2.3.5.3 Overview of environment related public information policies and practices**

There have been several interventions by the Government and interested development partners (NGOs) in salvaging the degenerating environmental conditions. The Government has made policies and legislations that are geared towards public information on the environment. These policies have been used by environmentally minded NGOs and individuals to embark on sensitisation programmes.

Beyond information is public involvement in environmental management. To this extent, one of the government policies has created the National Commission on the Environment and Forestry (NaCEF). This Commission is pushing the Stockholm Convention's agenda through public involvement and contribution to the National Implementation Plan (NIP) on POPs. There is also the Association of Environmental Journalists which publishes articles in newspapers on matters relating to the environment. Further investigations revealed that the SLBSTV used to have a programme called "Enviroscope" that showed the level of degradation of the environment and possible corrective measures. Furthermore, certain days in respect of the environment, such as the National Tree Planting Day, are set aside for public activities nationwide.

The Environment Protection Act 2000 makes provision for public participation in environmental impact assessment. Section 19 (2) states that, "the Director shall make environmental impact assessment open for public inspection and comments". Section 19 (3) further states that, "comments made under subsection 2 above shall be submitted within fourteen days of the last publication in the Gazette (a government document) or a new paper as the case may be".

In addition to the above, there is a whole portion in the National Environmental Policy, revised edition (October 1994), on public participation whose goal is to raise public awareness and promote the understanding of essential linkages between environment, population and development, and to encourage individual and community participation in environmental efforts to improve the quality of life. It will ensure among others:

- Broad public participation towards defining quality environmental objectives
- Promotion, support and adoption of community based approaches to public education and enlightenment through culturally relevant social and religious groups, NGOs and other voluntary organisations
- Organising intensive campaigns
- Inclusion of environmental programmes in curricula of educational institutions



- Education of management and workers on dangers posed by industrial emissions and other forms of pollution

### *Environment Impact Assessment as a Public Priority*

Like in most other countries, the people of Sierra Leone are informed and involved in other environmental issues but POPs. Except indirectly, relevant laws and general environmental issues do not specifically mention and emphasise public awareness on POPs. Environmental issues are the concerns of every one, meaning that the general public should be aware about every aspect of it from policy formulation to implementation of environmental action plans.

#### *2.3.5.3.1 Public information tools*

Since December 2006, meetings and consultations have been held to agree on the following information tools to ensure maximisation of information flow on POPs.

- a. Handbook on the Stockholm Convention
- b. Newspaper articles
- c. Radio interviews and television discussions
- d. Others

#### *Radio and television*

Considering the low level of literacy in the country, the radio was unanimously agreed to be the most effective tool in terms of coverage and language use. In this regards, Talking Drum Studio was chosen for radio discussions to be held in Krio. Recordings of these discussions were distributed to 19 community radio stations nationwide to be aired at regular intervals for a two week period.

Also SLBSTV, though it has a small number of viewers in Freetown only, was used to present a picturesque view of the threats and levels of devastation by POPs. Pictures of identified contaminated sites were televised for people to see and appreciate the degree of the threat and to begin to think about alternatives and controls.

#### *Newspapers/handbills/posters*

Despite the low literacy level, still an appreciable number of people read newspapers and other documents on a daily basis. Thus, the Association of Environmental Journalists (AEJ) and other journalists were invited to meetings so that they could be adequately informed and encouraged to publish the information on POPs. Furthermore, spot interviews were conducted which were also given wide publicity in the newspapers. These newspapers are distributed at least at the regional level.

Handbills and posters with eye-catching messages and pictures were pasted on public notice boards in schools/colleges and local councils in Bo, Makeni and Kenema for public viewing.

#### *Others*

To maximise the impact of this exercise on POPs, discussions, visits and meetings formed part of the process. Of unique importance was the membership of a pastor on the Team who ensured that messages on POPs/PCBs were included in his Sunday sermons and the church meetings. Other members of the Team also used various opportunities to spread the message in different fora.





#### **2.3.5.4 Assessment of existing public information and awareness**

There have been several attempts at pointing out environmental degradation by interested NGOs and the Government through public involvement and information. There used to be nature clubs in schools, the “Enviroscope” programme on Sierra Leone Broadcasting Station Television (SLBSTV) and now, Environmental Journalists. But even so, POPs is yet to be singled out and given the prominence it deserves as far as public awareness is concerned.

Strengths of the Task Team for Awareness-raising , Education and Access to Information are the support from NaCEF, the training received in December 2006, the motivation and ability of the team members.

Challenges are the low level of public knowledge about POPs, the lack of sufficient information material, the insufficiency of POPs specific awareness programmes, the lack of data on POPs containing pollutants and the limitations on use of information outlets.

#### **2.3.5.5 Recommendations**

Education on POPs should be included in school curricula; policy makers and other target groups should be regularly trained.

Specific suggestions for awareness-raising:

- i. Increased awareness-raising programs at regular intervals using especially radio folklore and mime
- ii. Inclusion of importers, dealers and users of POPs containing chemicals in awareness-raising programmes
- iii. Encouraging interested NGOs, ministries, departments, agencies and civil society groups in awareness-raising on POPs and other pollutants
- iv. Building, improving and regularly updating a database on POPs and other pollutants with a trained database manager
- v. Ensuring experience sharing with other countries
- vi. Increased support for information generation and dissemination
- vii. Creation of a website by NaCEF for POPs information
- viii. Identification of more risk communities for regular sensitisation visits
- ix. Provision of affordable and accessible alternatives to POPs emitting substances



## 3. STRATEGY AND ACTION PLAN ELEMENTS OF THE NATIONAL IMPLEMENTATION PLAN

### 3.1. Policy Statement

Sierra Leone participated in the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in 1992. At this Conference, Heads of States or Governments adopted “Agenda 21” – a document that seeks, among other things, to enhance sound management of chemicals. The document, outlined responsibilities of every nation towards the collective achievement of sustainable development. Of special relevance for chemicals management is the chapter 19 of “Agenda 21” which deals with environmentally sound management of chemicals, including illegal international traffic in toxic and dangerous products.

In response to this global concern, the Government of Sierra Leone has taken concrete steps and measures to meet its obligations in achieving sustainable environmental protection and economic development. This led to the development of Local Agenda 21, National Environmental Action Plan (NEAP), and the National Environmental Policy (NEP) for Sierra Leone. The ultimate aim of the overall National Environment Policy (NEP) of Sierra Leone is to achieve sustainable development in Sierra Leone through sound environmental management. The policy, specifically, seeks to:

- (i) Secure for all persons resident in Sierra Leone now and yet unborn an environment suitable for their health and well-being;
- (ii) Promote efficient utilization and management of the country’s natural resources and encourage, where appropriate, long term self-sufficiency in food, fuel wood and other energy requirements;
- (iii) Facilitate the restoration, maintenance and enhancement of the ecosystems and ecological processes essential for the functioning of the biosphere and prudent use of renewable resources;
- (iv) Enhance public awareness of the importance of sound environmental understanding of various environmental issues and participating in addressing them; and
- (v) Enhance co-operation with Governments and relevant international/ regional organizations, local communities, non-governmental organizations and the private sector in the management and protection of the environment.

### 3.2. Declaration of Intent

In line with the National Environmental Action Plan (NEAP) and the National Environmental Policy (NEP), the Government seeks among other things to “take appropriate measures, irrespective of the existing levels of environmental pollution and extent of degradation, to control pollution and the importation and use of potentially toxic chemicals”. This commitment has led to the development of the ozone depleting substances phase-out plan and also the promulgation of law to control the importation and use of harmful/hazard chemicals (including POPs).

Moreover, notwithstanding the role POPs have been playing in global and national development strives, the Government saw it necessary to accede to the Stockholm Convention on POPs. The Environment Protection Department being the host of the designated focal point is playing the leading role in promoting safe management and use of chemicals (including POPs) for industrial,



agricultural and public health in ensuring sustainable development.

Consequently, the EPD in collaboration with UN agencies (UNEP, UNIDO, etc.) have been undertaking a series of capacity building activities to ensure the strengthening of national capacity and capability that leads to effective and efficient chemical management. The efforts have enabled Sierra Leone to acquire skills in comprehensive chemical assessment and legislations/regulations and plans in the management/control of toxic chemicals. There is also a provision in the national legislation for environmental impact assessment. This has led to the reduction of activities that emit POPs chemicals. Furthermore, the NIP has created a framework on which to build on. In a dynamic world, emerging policies needs are to be easily related with the framework in national chemical management initiatives to ensure maximum efficiency and reduce duplication of efforts.

The NIP has therefore been developed to create an enabling environment for the reduction and ultimate elimination of POPs based on voluntary and non-voluntary approaches. The mechanism includes the adoption and application of alternatives to POPs at industrial and enterprise levels to ensure sustained recourse. The draft bill for chemical waste management is apt to support the NIP, hence enactment of the draft bill is of essence.

### *3.3. Implementation Strategy*

Sierra Leone does not produce POPs. In this context, the strategies to be developed have to focus on the following:

- Control of importation and use
- Raising awareness of decision makers and users
- Equipping the institutions involved with means of identification and intervention

#### **3.3.1 Priority areas identified by the stakeholders**

##### ***3.3.1.1 POPs pesticides***

- 1) Establishing laws governing the importation, storage, use and disposal of POPs pesticides
- 2) Creating a law enforcing body for POPs pesticides regulations
- 3) Building the capacity of the law enforcing body on POPs pesticides
- 4) Developing effective methods of use, storage and disposal of POPs pesticides and their empty containers
- 5) Developing an effective monitoring and evaluation mechanism to update inventories of POPs pesticides
- 6) Strengthening existing laboratories to ensure effective analysis of POPs pesticides
- 7) Sensitising the public on the importation, storage, use and disposal of POPs pesticides and their containers
- 8) Sensitising the public on the effects of POPs pesticides on human health and environment
- 9) Involving all stakeholders in pesticide management under the supervision of the law enforcing body
- 10) Developing alternatives to POPs pesticides through research



### **3.3.1.2 PCBs**

- 1) Strengthening the relevant institutions, e.g., universities, Ministry of Lands, Housing and country Planning and the Environment (especially the Environment Department) and the Standards Bureau
- 2) Keeping and updating inventories of PCBs
- 3) Minimising the effects of PCBs on human health and the environment
- 4) Domestic and municipal waste management
- 5) Sensitisation campaign
- 6) Community training and advocacy
- 7) Mainstreaming best management practices into development plans
- 8) Legal decommissioning and proper disposal of transformers and replacement of PCB-containing transformers or their oil

### **3.3.1.3 UPOPs**

- 1) Strengthening the relevant institutions, e.g., universities, Ministry of Lands, Housing and country Planning and the Environment (especially the Environment Department) and the Standards Bureau
- 2) Keeping and updating inventories of UPOPs
- 3) Minimising the effects of UPOPs on human health and the environment
- 4) Domestic and municipal waste management
- 5) Sensitisation campaign
- 6) Community training and advocacy
- 7) Mainstreaming best management practices into development plans
- 8) Technology shopping and popularisation of less harmful energy sources for cooking
- 9) Sensitising women and promoting the use of the new technology
- 10) Minimising the importation and use of leaded fuel, and fixing standards for importation of used vehicles
- 11) Advocating for the enforcement of the public non-smoking law

### **3.3.1.4 POPs contaminated sites**

- 1) Sensitisation on health and environmental impacts
  - Identification/involvement of stakeholders
  - Seminars
  - Workshops
  - Conferences
- 2) Capacity building/strengthening requirements
  - Remediation of existing contaminated sites
  - Waste management facilities
    - Hospital/medical wastes



- Pharmaceutical wastes
- Municipal wastes
- Industrial wastes with emphasis on PCBs
- Health and environmental monitoring capabilities
- Information management capacities
- Institutional and legal framework

### **3.3.1.5 Institutional policy and regulatory framework**

- 1) Enacting laws to govern POPs chemicals management – the law should provide for the institutional and administrative arrangement of a National POPs Centre
- 2) Harmonisation of policies at sub-regional level to enhance regional inspection at entry points
- 3) Development of a national monitoring plan for effective evaluation
- 4) Domestication of the Stockholm Convention into the national legal instruments
- 5) Capacity building
  - POPs centre (laboratory, equipment, logistics, etc.)
  - Recruitment and training
- 6) Financial resource mobilisation (at national and international levels)
- 7) Technical assistance provision under the MEAs
- 8) Research
  - Determination of levels of POPs (marine and fresh water environments and fisheries)
  - Promoting non-chemicals alternatives over current use of chemicals
  - Research into systems for awareness-raising, information dissemination and education
  - Research into existing customs and conventions with a view to review and upgrade current/obsolete laws, regulations standards, customs and conventions

### **3.3.1.6 Awareness-raising and sensitisation priority setting**

- 9) Raising public awareness on the Stockholm Convention on POPs
- 10) Capacity building
  - Organising district/council Task Teams
  - Identifying specific target groups
- 11) Information materials
  - Organising awareness-raising information materials
  - Setting up a Task Team for development of materials for sensitisation
  - Workshops on materials development



- Distribution of materials

12) Implementation of awareness-raising programmes

- Development of skills, jingles, billboards
- Radio discussions
- Meeting with parliamentarians and other policy makers and implementing institutions
- Conducting quizzes/essays (educational institutions and public)

### *3.4. Action Plans for the Implementation of the NIP*

The objectives to be pursued and attained through the NIP require the completion of priority actions as specified below in the action plans addressing the POPs situation in the country. The respective steps of the NIP described below are derived from this situation.

#### **3.4.1 Action Plan: Institutional and regulatory framework**

Sierra Leone has no specific laws on the importation, exportation and use of chemicals. Thus UNIDO contracted the services of an environmental lawyer to assist Sierra Leone to draft a legislation that is specific to industrial and agricultural chemicals to enable the country to implement the Convention. This was one of the priorities identified by stakeholders during the prioritisation workshop.

It was again revealed in the prioritisation workshop that a backlog existed in the drafting of new legislation, because Sierra Leone would not have a sufficient number of qualified jurists. In particular, hardly any legal expertise concerning environmental issues is available. Thus the institutional frame of reference for the implementation of the Stockholm Convention should include the following:

- Competent authority
- National Center for POPs Management and Remediation
- Analytical and toxicological laboratory
- Laboratory for studying the impacts of pesticides on human health and environment
- Evaluation commission
- Civil society

The ministry housing the environment portfolio assures compliance and control of implementation of regulatory texts on POPs management and remediation.

The National Centre for POPs Management and Remediation is a specialised and autonomous public service, charged with administrative and technical POPs management.

The analytical and toxicological laboratory will be a scientific and technical institution, charged with studying different aspects of applied toxicology; chemical, vocational, nutritional, veterinary and environmental toxicology and related fields. The desired reinforcement of the scientific and technical capacities of the existing National Public Health Laboratory should enable it to fill this role. To that aim it should directly collaborate with the universities and hospital centers in the country.



## Institutional framework for the national POPs policy

Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Set up POPs National Secretariat for NIP Implementation	EPD	POPs National Secretariat established	2008	20,000	GOSL
Review laws and regulatory	Ministry of Justice and Law Reform Commission	Legislation enacted	2008 - 2009	25,000	GEF
Identify and update institutions and agencies	Universities, Ministry of Education, Science and Technology	Institutions and agencies created or updated for POPs management	2008 - 2013	40,000	GEF
Clarify roles and responsibilities on POPs	EPD, sectoral ministries, industry, private sector	Specific roles and responsibilities identified	2008 - 2009	30,000	GEF
Develop functional national institutional linkages	EPD	Linkages developed	2008 - 2009	30,000	GEF
Define institutional roles and responsibilities on POPs		Institutional roles on POPs defined	2008 - 2009	30,000	GEF
Review and harmonise laws and policies	EPD, Ministry of Justice and sectoral ministries.	Acts on POPs and chemicals in general reviewed	2009	45,000	GEF
Develop guidelines to enforce regulations	EPD, sectoral ministries and stakeholders	Guidelines developed	2008 - 2010	35,000	GEF
Identify institutional gaps to POPs	EPD, sectoral ministries and stakeholders	Legislative gaps on POPs identified	2008	30,000	GEF
Review laws	Parliament	Laws on POPs passed	2008 - 2009	nil	GEF
Identify gaps and deficiencies in existing institutions	EPD & Stakeholders	Gaps & deficiencies identified	2009	50,000	GEF

Objectives	Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
	Develop regulations addressing the gaps	EPD & Ministry of Justice and stakeholders	New regulations developed	2010	80,000	GOSL
<b>Subtotal</b>					<b>415,000</b>	

### 3.4.2 Action Plan: Public information, awareness and education

According to Article 10 of the Stockholm Convention, the Government of Sierra Leone as a party and within its capabilities agrees to promote and facilitate information, awareness and education of the public on POPs, and ensure that this information is kept up-to date. It envisages the design of mechanisms for collection and dispersion of information of POPs as listed in the table below.

**Table 14: Action Plan: Public information, awareness and education**

Objective	Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
1. To create awareness among the public, policy and decision makers including traditional authorities, women and children	Identify relevant decision and policy makers/traditional authorities and involve them Organise workshops/seminars to sensitise various groups/stakeholders Design and implement appropriate public education programmes Translate materials into local languages and different forms Develop and support media education programmes	Sectoral ministries, universities, NGOs, CBOs and the media house	Relevant policy makers and other stakeholders involved in POPs management  10 Sensitisation workshops conducted in the 4 regions  Public awareness programmes conducted  Materials on POPs in local languages available  Client specific programmes including for women and children developed	3 months in 2008 - 2009  2008 - 2009  ongoing 2008 - 2025  2008 - 2011  2008	30,000  90,000  95,000  85,000  80,000	Donors  Donors  Donors  Donors  Donors



Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source	
Develop and produce awareness-raising materials (e.g., brochures, posters, newsletters,		Print materials produced	2008 - 2011	78,000	Donors	
Conduct needs assessment and prioritisation		Needs assessment carried out	2008	30,000	Donors	
Develop and implement a training and human resources development plan		Capacity building plan available and implemented	2008	60,000	Donors	
Develop and implement training modules for various categories of personnel		Training modules and materials produced	2008 - 2025	85,000	Donors	
Identify and train workers, scientists and community facilitators from various stakeholders	Sectoral ministries, universities, NGOs, CBOs, civil society and media	Trained human resources available	2008-2025	135,000	Donors	
Conduct awareness-raising campaigns and seminars		Seminars conducted	2008-2025	90,000	Donors	
Identify and train the focal points in existing institutions		Institutions having better delivery systems	2008 - 2012	105,000	Donors	
Integrate POPs education in secondary and college curricula		Curricula include focus on POPs	2008 -2010	110,000	Donors	
Facilitate networking with national and international stakeholders		Functional networks	2008 -2010	95,000	Donors	
					1,168,000	

## Polychlorinated biphenyls

Use is limited to specific applications, e.g., transformers. The Government of Sierra Leone, which does not have a ban on the use of PCBs, is implementing the measures described in the table below, which are appropriate for reducing or eliminating the

Measures	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Facilities for safe disposal of all PCBs and PCB containing equipment	Ministry of Health and Sanitation, private sector and local councils	Functional facilities in place	2008 - 2017	600,000	
Warning signs near disposal sites, especially where unlicensed units are used prior to disposal		Warning signs in place	2008 - 2025	10,000	
Use training for personnel involved in handling of PCBs		Training programme organised	2008 - 2012	25,000	Donors
Review and finalise arrangements for the disposal of PCBs and PBC containing equipment		Mechanism for disposal established	2008 - 2014	400,000	
Procure packaging equipment/technology for disposal		Packaging equipment for disposal procured; disposal technology identified	2009 - 2010	500,000	
Limit the use of PCBs and PCB containing materials	National Experts, universities and research institutions	Use of PCB materials determined	2009 - 2010	80,000	Donors
Develop a database	EPD	Database developed	2008 - 2009	20,000	
Implement measures for protection of human health	MOH	Health protection measures improved	2008 - 2012	60,000	

Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Develop and arrange for the disposal of PCBs	EPD	Disposal arrangements in place	2008 - 2010	500,000	
Develop and implement a phase-out program	EPD	Phase-out program in place	2008 - 2010	180,000	
Develop suitable analytical methods for PCBs	EPD and the universities	Analytical capacities identified	2008 - 2010	20,000	Donors
Establish reference methods for measuring content of PCBs in closed, partially closed and open applications	EPD and NPA	Reference methods established	2009	50,000	Donors
Determine presence and concentrations of PCBs in equipment and in newly produced transformer oils	EPD and NPA	PCB in equipment and oils identified and analyzed	2009	50,000	Donors
Monitor and assess impact of PCBs on humans and environmental media	EPD and MOH	Impact assessed and reported	2009 - 2025	60,000	Donors
Identify appropriate technologies for disposal of PCBs	Research institutions	Appropriate technologies identified	2009 - 2016	100,000	Donors
Conduct studies on PCBs in vulnerable communities living among the exposed sites	Universities	Studies conducted	2009 - 2025	500,000	Donors
				<b>3,155,000</b>	

## locally produced POPs

Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Develop technology, import standards and procedures phase out outmoded technologies	Sierra Leone Standards Bureau, universities and research institutions	Minimum standards developed	2009 - 2011	100,000	Donors
Conduct a regular monitoring of releases	Universities, research institutions	Levels of emissions monitored	2009 - 2025	40,000	Donors
Develop and support research on alternative technologies	EPD, universities, research institutions	Active research in place	2009 - 2025	100,000	Donors
Phase out outmoded equipment and chemical processing equipment	MOH and EPD	Outmoded equipment phased out	2009 - 2013	80,000	Donors
Improve skills through management courses on monitoring assessments	EPD, universities, research institutions	Trained staff well involved	2008 - 2020	80,000	Donors
Conduct public awareness and education	EPD, universities, research institutions	Significant increase of awareness in the population	2008 - 2020	60,000	Donors
Strengthen analytical ability of research laboratories	EPD, universities, research institutions	Research institution well capacitated	2008 - 2020	100,000	Donors
Acquire equipment for the analysis of PCDD/PCDF, and PCBs	EPD, universities, research institutions	Research institutions well equipped	2008 - 2020	100,000	Donors
Develop and implement M&E systems for sources to estimate of unintentional releases	EPD, universities, research institutions	M&E systems in place	2009 - 2025	40,000	Donors

Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Acquire and install more robust technologies	EPD, universities, research institutions	Robust technologies installed and functional	2008 - 2025	500,000	Donors
Identify key sites for replacement of equipment to prevent excessive releases of PCBs and furans	EPD and relevant stakeholders	Sites identified	2008 - 2016	40,000	Donors
Identify appropriate equipment in relevant sites	Research institutions and stakeholders	Equipment installed	2008 - 2015	50,000	Donors
Develop policies and regulations for UPOPs prevention	EPD	Effective policies and regulations for UPOPs prevention adopted	2008 - 2011	20,000	Donors
				<b>1,310,000</b>	

## Contaminated sites

(e) of the Convention, Sierra Leone has strived to elaborate appropriate strategies for the identification of sites listed in Annexes A, B or C. The measures presented on the table below are envisaged for decontamination and

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es

Measures	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Establish the National Contaminated Sites Identification Unit	EPD	Coordination mechanism in place	2008 - 2009	30,000	GOSL
Define and prioritise contaminated sites at stakeholder workshop		Assessment and priority selection by the stakeholders finalised	2008 - 2012	25,000	
Conduct regular assessment of contamination of sites	EPD, MOH, universities	Periodic assessment in place	2008 - 2025	96,000	GOSL
Take corrective measures		Sites mitigated	2008 - 2025	90,000	
Assess needs and priorities capacity building	EPD	Needs and priorities assessed	2008 - 2009	40,000	Donors
Conduct in-house training course	EPD	Cadre of trained personnel at all levels available	2008 - 2025	100,000	Donors
Provide training and technical assistance to research institutions	EPD	Infrastructure improved	2009 - 2012	90,000	Donors
Facilitate and support local and international networking	EPD	Functional local and regional networks available	2008 - 2010	30,000	Donors

Activities	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Support research activities	EPD	Research implementation	2008 - 2025	105,000	Donors
Develop monitoring systems on sampling, analysis and reporting	EPD	Monitoring plan put in place	2008 - 2009	15,000	Donors
Develop and implement monitoring programme	EPD	Monitoring programme put in place	2009 - 2010	1,000,000	Donors
Train experts on monitoring systems (sampling, analysis and reporting requirements)	International experts	Trained experts available	2009 - 2011	40,000	GEF
				1,661,000	

### 3.4.6 Action Plan: Pesticides

Table 18: Action Plan POPs pesticides

Objective	Activity	Implementer	Performance Indicator	Time Frame	Cost USD	Source
0. Reinforcement of the judicial framework for pesticides	Draft a law on pesticides	Ministry of Justice and Parliament	Law drafted and enacted	2008 - 2009	40,000	GOSL
	Develop a mechanism for registering all imports and exports of chemicals	Ministry of Agriculture	Register of imports and exports developed	2008 - 2009	45,000	GOSL
1. To establish an effective M&E systems for use, import and export, stockpiles and waste of Annex A pesticides.	Develop protocols for disposal of chemical stockpiles including POPs contaminated products and articles	Crop Protection Department and Task Team on pesticides	Protocols for chemicals disposal in place	2008 - 2009	40,000	Donors
	Monitor disposal of chemical wastes including POPs and illegal trade	EPD, Ministry of Agriculture and FAO	Monitoring tools for chemical wastes available	2008 - 2025	15,000	Donors
	Protect or treat all contaminated sites of POPs pesticides	Private sector	Contaminated sites protected or treated	2008 - 2010	30,000	Development partners
	Develop codes of practices and standards	Ministry of Agriculture	Codes and standards developed on chemical practices	2008 - 2010	1,000,000	Donors
2. To enhance the institutional and human capacity for sustainable management of POPs pesticides	Dispose of all existing pesticide stockpiles appropriately	Private sector	Amount of chemical stockpiles disposed	2008 - 2010	55,000	Development partners
	Organise National Multi-Sectoral Committees on Chemical Management in Sierra Leone (NMSCCSL)	Ministry of Agriculture	NMCCSL formed	2008	1,000	GOSL
	Develop TORs for NMSCCSL	Ministry of Agriculture	TORs developed	2008	50,000	GOSL



	Implementer	Performance Indicator	Time Frame	Cost USD	Source
... meetings for ... SL and implementers	Ministry of Agriculture	Meetings conducted	2008 - 2025	10,000	GOSL
... short courses on ... als management in ... y and abroad	EPD	Personnel attended chemical short courses	2008 - 2009	100,000	Donors
... relevant equipment ... micals management	Ministry of Agriculture	Equipment procured	2008 - 2012	20,000	GOSL
... mechanism for review, ... and approval of ... d pesticides	Ministry of Agriculture	Mechanism for approval effected	2008 - 2009	10,000	GOSL
... ce and implement ... on impacts of ... le contamination in ... Leone	Ministry of Agriculture	Various studies undertaken on POPs impact relevant to Sierra Leone	2008 - 2025	50,000	Donors
... grants for research ... s pesticide ... tives	Ministry of Agriculture	Number and amount of grants secured	2008 - 2025	40,000	Donors
... ke BAT and BEP ... strations in key ... cural programmes ... ng integrated pest ... ement (IPM) and ... ted vector ... ement (IVM) at ... old level	Ministry of Agriculture	Numerous sessions conducted on IMP and IVM or its equivalent	2008 - 2025	500,000	Develop- ment partners
				2,006,000	

**Use, stocks and waste of DDT**

Production, use and stocks of chemicals inscribed in Annex B, or containing them, and the waste consisting of chemicals or contaminated by them, are managed appropriately to protect human health and environment, the planned measures as described in the table below.

**Use, stocks and waste of DDT**

Activity	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Develop a detailed inventory	Project coordinator, national consultants	Inventory updated	3 months in 2008 - 2009	50,000	Donors
Assess needs for integrated pest management (IVM) and update IVM	National experts and international expert	IVM needs evaluated and addressed	3 months in 2008 - 2009	50,000	Donors
Evaluate DDT alternatives	National experts	DDT alternatives evaluated	3 months in 2008 - 2009	15,000	Donors
Manage DDT stocks safely	International expert	DDT stocks managed	1 month in 2008 - 2009	50,000	
Train trainers	International expert	Trainers trained	6 months in 2008 - 2009	30,000	
Eliminate DDT stocks in an environmentally sound manner	Ministries of Agriculture, EPD, international expert, FAO and NGOs	DDT stocks eliminated	1 month in 2008 - 2009	15,000	Donors
				<b>210,000</b>	

## Specific exemptions

Steps to undertake the measures listed in the table below for the registration of specific exemptions in the Convention.

### Specific exemptions

	Implementer	Performance Indicator	Time Frame	Cost USD	Source
Use a stakeholder meeting in order to define selection criteria for chemical substances that may be eligible for specific exemptions	EPD	Stakeholder meeting held	2008 - 2009	10,000	GOSL
Conduct a workshop on refining inscription	National experts	Workshop conducted	2008 - 2009	10,000	
Establish a national center for chemicals management	National experts	Center established	2008 - 2009	20,000	
Draft protocols for notifying Secretariat of the Convention	National experts	Protocols drafted	2008 - 2025	5,000	
Define procedures for reviewing and selecting substances for exemptions	National experts	Procedures defined	2008 - 2009	5,000	
Carry out reviews of the needs for specific exemptions	National experts	Review carried out	2008 - 2009	2,000	
Carry out reviews of the needs for continuing specific exemptions	National experts	Reviews carried out	2012 - 2025	2,000	
				<b>54,000</b>	

**Exchange and involvement of stakeholders**

The Government intends to undertake the exchange of information relevant to the reduction or elimination of the production, use and distribution of POPs.

**Exchange and involvement of stakeholders**

Activity	Implementer	Performance Indicator	Time Frame	Cost	Source
Establish a National Focal Point for the exchange of information	EPD	National Focal Point established	2008 - 2009	5,000	GOSL
Equip the Focal Point with the necessary equipment		Functional FOCAL point appropriately equipped		90,000	
Develop and adapt rules and guidelines for information exchange and for facilitating stakeholders' involvement	EPD	Rules and guide lines put in place	2008	20,000	GOSL
Ensure continuous monitoring, assessment and collection and exchange of information and		Flow of information functional	2008 - 2025	75,000	
				<b>190,000</b>	

**evaluation**

comparable monitoring data on the presence of chemicals listed in Annexes A, B and C for future use by

**uation**

	Implementer	Performance Indicator	Time Frame	Cost	Source
place systems to r and evaluate the NIP a Leone	EPD	Systems developed	2008 - 2009	5,000	Donors
ut periodic evaluation mpacts of the NIP		Reports on periodic evaluation available	Periodically	40,000	
				45,000	

to the Conference of Parties on the measures it has taken to implement the provisions of the Convention and on  
n meeting the objectives of the Convention.

	Implementer	Performance Indicator	Time Frame	Cost	Source
y measures taken to ent the Convention valuate their veness	EPD	Evaluation report	2008	45,000	Donors
e statistical data on tion, import and export nicals	EPD	Statistical data available	2009	30,000	Donors
e and submit national to the COP	EPD	Reports submitted	Every year	25,000	Donors
				100,000	

**Development and monitoring**

encourage and/or undertake appropriate research, development, monitoring and cooperation pertaining to POPs.

**Development and monitoring**

	Implementer	Performance Indicator	Time frame	Cost	Source
Conduct periodic studies on POPs and releases for each category of POPs	EPD, MOH, universities and research institutions	Study report available	2008 - 2025	350,000	Donors
Develop a system and methodology for the presence and monitoring of POPs in humans and environment	EPD, MOH, universities and research institutions	Monitoring system available	2008 - 2025	350,000	Donors
Conduct periodic studies on health, environment and economic impacts of POPs	EPD, MOH, universities and research institutions	Study reports available	2008 - 2025	450,000	Donors
				<b>1,150,000</b>	

**financial assistance**

submit requests to donors for funding the successful implementation of the Convention.

**financial assistance**

	Implementer	Performance Indicator	Time frame	Cost	Source
...ct assessment on the ...al and financial short, ...n and long term needs	EPD	Financial and technical needs assessed	2008 - 2020	55,000	GEF
...y potential donors	EPD	Potential donors identified	2008 - 2020	20,000	GOSL
...e and submit project ...als to donors for ...	EPD	Proposals submitted	2008 - 2020	70,000	GOSL
				<b>145,000</b>	

## Implementation and Measures of Success

### and target milestones

	Timeframe	Target Milestones
ork	2008 - 2010	Strengthened the POPs Coordination Centre by 2008 Legislation on agricultural and industrial chemicals established by 2010
education	2008 - 2025	Public information, awareness and education on POPs promoted and facilitated by 2008 Training, education and awareness programmes operational by 2009
	2008 - 2018	Disposal of PCB contaminated equipment by 2017 Database of PCBs improved by 2012
	2008 - 2012	Emissions controlled by 2013
	2008 - 2025	Awareness creation programmes are established by 2009 Sites contaminated by POPs pesticides are cleaned up by 2017 Database on contaminated sites established by 2011
	2008 - 2017	Alternatives to POPs pesticides improved by 2013
	2008 - 2017	Management strengthened and controlled by 2012
	2008-2012	Register of specific exemptions established by 2012
der involvement	2008 - 2025	Information database on POPs established by 2009 Accessibility and information dissemination enhanced by 2014
	2008 - 2025	Monitoring and evaluation capacity strengthened by 2010
	2008 - 2025	Enhanced inter-institutional reporting capacity by 2009 Timely reporting according to the Convention's obligations by 2008
oring	2008 - 2025	Sources and releases of POPs in the environment established by 2014
	2008 - 2020	Funds for NIP implantation mobilised by 2015









Action Plan: PCBs													
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Till 2025
Develop and implement a phase-out program													
Identify suitable analytical capacities for PCBs													
Establish reference methods for measuring content of PCBs in closed, partially closed and open applications													
Determine presence and concentrations of PCBs in equipment and in newly imported transformer oils													
Monitor and assess impact of PCBs on humans and environmental media													
Identify appropriate technologies for disposal of PCBs													
Conduct studies on PCBs in selected communities including among the exposed workers													





Action Plan: Contaminated sites													
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Till 2025
Support research activities													
Mobilise resources													
Develop monitoring guidelines on sampling, analysis and reporting													
Develop and implement a monitoring programme													
Train experts on monitoring activities (sampling analysis and reporting requirements)													

Action Plan: Pesticides													
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Till 2025
Draft a law on pesticides													
Develop a mechanism for registering all imports and exports of chemicals													
Develop protocols for disposal of chemical stockpiles including POPs contaminated products and articles													
Monitor disposal of chemical wastes including POPs and illegal trade													
Protect or treat all contaminated sites of POPs pesticides													
Develop codes of practices and standards													

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Till 2025
es appropriately										
tees on Chemical Management in Sierra Leone (NMSCCSL)										
plementers										
management in country and abroad										
als management										
d approval of licensed pesticides										
ffects of pesticide contamination in Sierra Leone										
esticide alternatives										
s in key agricultural programmes including integrated pest management (IPM) and integrated vector management (IVM)										











### 3.6. Resource Requirements

Action Plan	Cost USD
1. Institutional and regulatory framework	415,000
2. Public information, awareness and education	1,168,000
3. Polychlorinated biphenyls	3,155,000
4. Unintentionally produced POPs	1,310,000
5. Contaminated sites	1,661,000
6. Pesticides	2,006,000
7. DDT	210,000
8. Register of specific exemptions	54,000
9. Information exchange and involvement of stakeholders	190,000
10. Effectiveness evaluation	45,000
11. Reporting	100,000
12. Research, development and monitoring	1,150,000
13. Technical and financial assistance	145,000
<b>Grand Total</b>	<b>11,609,000</b>



## ANNEX 1 – CONTACTS

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	Ministry of Trade and Industry		
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	Ministry of Foreign Affairs		076-738497

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	Ministry of Health & Sanitation		



## ANNEX 4: RECORD OF STAKEHOLDER AND PUBLIC CONSULTATION

The Stakeholders and the general public were regularly involved by the Project Coordinating Unit (PCU) in necessary steps of conducting activities. Thus, these two partner categories participated in the following official meetings:

1. Inception Workshop of the Project “Enabling Activities for the Development of National Implementation Plan (NIP) of the Stockholm Convention”  
Freetown, 5 December 2006

No.	Name	Institution
1	Iyesha Kamara Josiah	Civil Society
2	Patrick Macarthy	Ministry of Health
3	Ekukabba – Kamara	Ministry of Health and Sanitation
4	John Kaisum	Njala University
5	Johnny E. Norman	Njala University
6	James D. Spencer	Njala University
7	Gerald D.S Hadd	Total Oil Sierra Leone Limited
8	Allieu Bakarr – Conteh	Ministry of Energy and Power
9	Abdul Amara	Geological Survey, MMR
10	Sheku M. Kanteh	Crop Protection Department
11	Viollette Elliott	Ministry of Trade and Industry
12	Dr. Bashiru M. Koroma	Njala University
13	Hassan R. S. Mohamed	National Commission on the Environment and Forestry
14	Victor John- Cole	Cement Factory
15	Adama Kamara	Sierra Leone Standard Bureau
16	Manya Farma	Sierra Leone Standard Bureau
17	Saffa Saidu	Ministry of Health and Sanitation
18	T. J. Charles	Ministry of Health and Sanitation
19	S. M. Momjah	Ministry of Trade and Industry
20	T. B. R. Yormah	Fourah Bay College
21	James S. Dumbuya	Sierra Leone Standard Bureau
22	A. A. Karim	Fourah Bay College
23	Saidu Samura	Ministry of Energy and Power
24	Mohamed Pabai	Consumer Protection
25	Morie Momoh	Ministry of Finance
26	E. G. Macaulay	Ministry of Trade and Industry
27	Sulaiman Z. Parker	Freetown City Council



No.	Name	Institution
28	John B. Koroma	Crop Protection Unit
29	Femi Im Kamara	Ministry of Mineral Resources
30	Alie M. Kamara	Ministry of Health and Sanitation
31	Sheku A. Mansaray	National Commission on the Environment and Forestry
32	Abdul – Abib F. Conteh	National Commission on the Environment and Forestry
33	Dan Manson	Protection Unit
34	Simeon Fatoma	Ministry of Local Government and Community Development
35	Edward P. Bendu	National Commission on the Environment and Forestry
36	Olatunde Johnson	Friends of the Earth (SL)
37	Ibrahim Seibrue	Concord Times
38	Abu Bakarr Kamara	Ministry of Energy and Power
39	Magnus John	Ministry of Information
40	Alfred Sesay	Friends of the Earth
41	Sybil Jusu	Environment Department
42	Momodou A. Bah	Environment Department
43	J. S. Kamara	Environment Department
44	Edwin Baimba	Environment Department
45	Edward P. Bendu	Environment Department
46	Lahai S. Keita	Environment Department
47	S. A. Lappia	Environment Department
48	Fatamata P. Demby	Environment Department
49	Maseray Mansaray	Environment Department
50	Hawa Turay	Environment Department
51	Momorie Jibateh	Ministry of Education

2. Training Workshop on Initial Inventories  
Freetown, 6 – 8 December 2006

No.	Name	Institution
1	Femi I. Kamara	Ministry of Mineral Resources
2	Abu Bakarr Kamara	Ministry of Agriculture
3	Hokie Massaquoi	Njala University
4	John Kaisum	Njala University
5	Johnny E. Norman	Njala University
6	James D. Spencer	Crop Protection Unit
7	Ekua Kabba kamara	Total Oil Sierra Leone Limited
8	Allieu Bakarr – Conteh	Ministry of Energy and Power
9	Abdul Amara	Geological Survey, Ministry of Mineral Resources

No.	Name	Institution
10	Sheku M. Kanteh	Crop Protection Department
11	Viollette Elliott	Ministry of Trade and Industry
12	Dr. Bashiru M. Koroma	Njala University
13	Jusu S. P. Squire	National Commission on the Environment and Forestry
14	Patrick Macarthy	Cement Factory
15	Harding M. Swaray	Sierra Leone Standard Bureau
16	Manya Farma	Sierra Leone Standard Bureau
17	Saffa Saidu	Ministry of Health and Sanitation
18	T. J. Charles	Ministry of Health and Sanitation
19	S. M. Momojah	Ministry of Trade and Industry
20	T. B. R. Yormah	Fourah Bay College
21	Sybil S. J. Jusu	National Commission on the Environment and Forestry
22	A. A. Karim	Fourah Bay College
23	Saidu Samura	Ministry of Energy and Power
24	Simeon P. Fatoma	Consumer Protection
25	Morie Momoh	Ministry of Finance
26	E. G. Macaulay	Ministry of Trade and Industry
27	Edwin Baimba	National Commission on the Environment and Forestry
28	John B. Koroma	Crop protection unit
29	Saidu Samura	Ministry of Energy and Power
30	Alie M. Kamara	Ministry of Health and Sanitation
31	Samuel A. Lappia	National Commission on the Environment and Forestry

3. Training on Action Plan Development  
Freetown, 3 – 5 September 2007

No.	Name	Institution	Phone
1	Stephen M. Momogoi	Trade	076-775352
2	Raymond Sannoh	Sierra Leone Port Authority	030-275903
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20	Eward P. Bendu	NaCEF	076-749024
21	Kekurah Bangura	Law Officers Department	076-763405
22	Alice Kandeh	Local Government	076-783406
23	Abu Bakarr Sesay	Ministry of Education	033-736326
24	Fatmata Bangura	Conservation Society of Sierra Leone	033-533272
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4. Validation Workshop for the Result of the Initial POPs Inventories  
Freetown, 29 October 2007

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5	Abu Bakarr Kamara	Crop Protection	033-885428
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28	Mohamed Fofana	Awoko Newspaper	
29	Jabez Lasayo	Ministry of Transport and Aviation	
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35	Elizabeth Jackson	National Petroleum	
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42	Peter Osman Kargbo	Ministry of Agriculture	
43	Joseph J. Cole	Ministry of Trade ad Industry	
44	Aiah K. Fillie	Ministry of Energy and Power	
45	Tamba P. Ngegba	Ministry of Energy and Power	
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47	James N. Momoh	Community Business Organization	
48	Sahr M. Morsay	Community business Organization	
49	A M. Turay	Ministry of Foreign Affairs	
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5. Prioritization and NIP Development Workshop  
Freetown, 30 October – 2 November 2007

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45	Tamba P. Ngegba	Ministry of Energy and Power	
46	Ahmed M. Daramy	Law Officers Department	
47	James N. Momoh	Community Business Organization	
48	Sahr M. Morsay	Community business Organization	
49	A M. Turay	Ministry of Foreign Affairs	
50	Joseph C. K. Tommy	Ministry of Health and Sanitation	
51	Bernard Jusu	Ministry of Health and Sanitation	
52	Evelyn Frazer	Local Council Kenema	
53	Beatrice Leigh	Local Council Kenema	
54	Jasmine Koroma	Local Council Bo	
55	Joseph M. K. Sinnah	Local Council Bo	
56	Julius B. Saffa	Local Council Kambia	
57	H. O. Peacock-Sawyer	Local Council Port Loko	

6. POPs Legislation Development Workshop  
Freetown, 26 – 29 November, 2007

No.	Name	Institution
1	Usman Bangura	Ministry of Lands
2	Simeon P. Fatoma	Ministry of Agriculture
3	John Banie Koroma	Ministry of Health and Sanitation
4	Monya Farma	Sierra leone Standards Bureau

No.	Name	Institution
5	Johnny E. Norman	Njala University
6	James D. Spencer	Ministry of Agriculture
7	Alice Kandeh	Ministry of Local Government
8	Allieu Bakarr – Conteh	Ministry of Energy and Power
9	Abdul Amara	Geological Survey, MMR
10	Sheku M. Kanteh	Crop Protection Department
11	Viollette Elliott	Ministry of Trade and Industry
12	Dr. Bashiru M. Koroma	Njala University
13	Edwin Baimba	Ministry of Education
14	Victor John- Cole	Cement Factory
15	Kate M. B. Garnet	Sierra Leone Standard Bureau
16	Mitta Johnny	Sierra Leone Standard Bureau
17	Saffa Saidu	Ministry of Health and Sanitation
18	T. J. Charles	Ministry of Health and Sanitation
19	S. M. Momojah	Ministry of Trade and Industry
20	T. B. R. Yormah	Fourah Bay College
21	James S. Dumbuya	Sierra Leone Standard Bureau
22	A. A. Karim	Fourah Bay College
23	Saidu Samura	Ministry of Energy and Power
24	Mohamed Pabai	Consumer Protection
25	Morie Momoh	Ministry of Finance
26	Maseray Mansaray	Environment Department
27	Fatmata P. Demby	Law Officers Department
28	Hawa Turay	Law Officers Department
29	Syril S. J. Judsu	Environment Department
30	Edward Bendu	Ministry of Transport and Aviation
31	Martina Koroma	Law Reform Commission



## **ANNEX 5: GOVERNMENT AND KEY STAKEHOLDER ENDORSEMENT DOCUMENTS**