

ENVIRONMENTAL PROTECTION AGENCY - GHANA



NATIONAL IMPLEMENTATION PLAN OF THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS

ACCRA, DECEMBER 2007

ACKNOWLEDGEMENTS

The successful preparation of Ghana's National Implementation Plan (NIP) for the Stockholm Convention on Persistent Organic Pollutants (POPs) is another success story of a multi-stakeholder collaboration for the sound management of chemicals in Ghana. The hardwork, cooperation and support by all national stakeholder institutions and individuals deserve recognition and appreciation.

We are highly grateful to the Global Environment Facility (GEF) for providing financial support for the NIP Development and UNIDO which served as Implementing Agency and for also providing technical support. The United Nations Institute for Training and Research (UNITAR) is highly appreciated for conducting training in Action Plan development and also for reviewing the NIP document.

We would like to express our profound gratitude to the team of national experts, who were involved at different stages in the course of developing the NIP, for their invaluable time and input. We are particularly indebted to the following individuals and their respective institutions that constituted the National Coordinating Team/Project Steering Committee: Mr. Edward Osei Nsenkyire (formerly of Ministry of Environment and Science, Chairman); Mr. Jonathan A. Allotey (Environmental Protection Agency, National Project Director); Mr. John A. Pwamang (Environmental Protection Agency); Mr. Sam Adu-Kumi (Environmental Protection Agency, National Project Coordinator); Dr. Rexford Osei (formerly of Ministry of Environment and Science); Dr. (Mrs.) Edith Clarke (Ministry of Health/Ghana Health Service); Mr. Vesper Suglo (Ministry of Food and Agriculture/Plant Protection and Regulatory Services Directorate); Mrs. Margaret Ahiadeke (Environmental Protection Agency); Mrs. Dinah Brandful (Customs, Excise and Preventive Service); Mr. Issah Nikabs (Ministry of Trade, Industry, Private Sector Development and President's Special Initiative); Mr. John Wartemberg (Electricity Company of Ghana); Mr. Fred Ohene-Mensah (Ministry of Manpower Development and Employment/Department of Factories Inspectorate); Prof. P. O. Yeboah (Ghana Atomic Energy Commission); Prof. Derick Carboo (Department of Chemistry, University of Ghana); Prof. A. Ayensu (Council for Scientific and Industrial Research); Mr. Emmanuel A. Mensah (General Transport and Petroleum Workers Union of Trades Union Congress of Ghana); Mr. Prince Agyeman-Yeboah (Association of Ghana Industries/Chemico Ghana Limited); Mr. John Awuku Dziwornu (Ghana National Association of Farmers and Fishermen).

We are equally grateful to the following personalities who served on the various Expert Task Teams: Supt. Daniel J. Avorga (Ghana Police service); Mr. D. Owusu-Nyampong (Ghana Standards Board); Ms. Mercy Emma Kwaah (Attorney Generals Department); Dr. Beatrice Padi (Cocoa Research Institute of Ghana); Mr. Peter Biney (Ministry of Food and Agriculture/Plant Protection and Regulatory Services Directorate); Prof. J. H. Ephraim (Ghana Chemical Society); Dr. S. Osafo Acquah (Department of Chemistry, Kwame Nkrumah University of Science and Technology); Mr. J. Martey (Food and Drugs Board); Mrs. Elizabeth Adetola (Ghana Standards Board); Dr. E. K. Takyi (Noguchi Memorial Institute); Mr. L. D. Atsiatorme (formerly of Environmental Protection Agency); Mr. R. Yeboah-Asuamah (Ghana Broadcasting Corporation); Mrs. Sakeena Bonsu (Evergreen Club); Mr. E.A. Gyamera (Ghana Education Service); Mr. J. E. Jainie (Chieftaincy Secretariat).

The following persons who constituted the Secretariat also deserve mentioning: Mr. Joseph C. Edmund; Mrs. Shirley Otinkorang; Mrs. Esther Anku; Mr. Michael Onwona-Kwakye; Mr. Charles Koomson; and Mr. Michael Pappoe.

Finally Mr. Redeemer Kowu, Mr. Daniel Amlalo, Mr. Samuel Anku, Dr. Johnson Boanuh, Mr. Albert Boateng all of the Environmental Protection Agency who reviewed the final draft document and provided very useful inputs are highly appreciated.

JONATHAN A. ALLOTEY,
EXECUTIVE DIRECTOR,
ACCRA, DECEMBER 2007

FOREWORD

Persistent Organic Pollutants (POPs) are among emerging global chemicals management concerns which demand urgent concerted action by governments, industry, civil society and the international community to reduce impacts on human health and the environment.

This project was coordinated by the Environmental Protection Agency in the framework of the “Enabling Activities to Facilitate Early Action on the Implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Ghana (UNIDO Contract Number: 2002/116; Project GF/GHA/02/003)”. The Global Environment Facility (GEF) funded the preparation of the NIP with the United Nations Industrial Development Organisation (UNIDO) acting as the GEF Implementing Agency.

Mr. Jonathan A. Allotey, the Executive Director of the Environmental Protection Agency served as the National Project Coordinator, whilst Mr. Sam Adu-Kumi, Principal Programme Officer also of the Environmental Protection Agency served as the National Project Coordinator. The Chemicals Control and Management Centre (CCMC) of EPA under the directorship of Mr. John A. Pwamang served as the Project Secretariat.

Ghana’s National Implementation Plan (NIP) elaborates the current POPs situation and details the commitments and actions that it intends to undertake in the management and control of POPs. The focus of the NIP is in line with the National Environmental Action Plan, and the Ghana Growth and Poverty Reduction Strategy (GPRS) towards the achievement of middle income status by 2015 among others. The implementation of the NIP is also an important step towards meeting the commitments of the World Summit on Sustainable Development whose goal is to ensure that, by 2020, chemicals are produced and used in ways that minimize their significant adverse effects on human health and the environment.

The necessity in promoting synergies among related Multilateral Environmental Agreements (MEAs) such as the Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal, the Rotterdam Convention on Prior Informed Consent (PIC) Procedure for Certain Chemicals and Pesticides in International Trade, among others is highlighted in the NIP.

Recognizing that the environment is the common heritage for present and future generations, the Government of Ghana will endeavour to support the implementation of the measures, actions and activities outlined in the NIP to reduce and ultimately eliminate POPs and other toxic substances from Ghana. All the nine pesticides covered by the Stockholm Convention have long been prohibited from use in Ghana. The challenges for the country therefore pertain mainly to PCBs, unintentionally produced POPs (dioxins and furans) from uncontrolled combustion processes and the management of sites contaminated by POPs and other toxic substances. The Action Plans of the NIP outlines priority areas that require attention for Ghana to realize the objective of the Stockholm Convention of protecting human health and the environment from the harmful impacts of POPs. The areas include the following:

- Information, education and communication strategy to create awareness on POPs;
- Improvement in policy and legal framework;
- Institutional strengthening and capacity building; and
- Development of appropriate and environmentally sound technologies, cleaner production and promotion of Best Available Techniques (BAT) and Best Environmental Practices (BEP);
- Development of infrastructure and technical capabilities for analyzing POPs in various environmental media.

It is envisaged that the National Implementation Plan will be updated as and when necessary to reflect future decisions made by the Government of Ghana and by the Conference of the Parties such as amendments to the Convention or its annexes, including the addition of chemicals to Annexes A, B or C.

I wish to thank all national stakeholders and our global development partners whose immense contributions made the preparation of this NIP possible. This Plan is certainly one of the most important elements towards Ghana's full compliance with the Stockholm Convention on POPs, and it significantly represents Ghana's contribution to the protection of the global environment.

HONOURABLE KWADWO ADJEI-DARKO, MP
MINISTER FOR LOCAL GOVERNMENT, RURAL DEVELOPMENT AND ENVIRONMENT
DECEMBER, 2007

ABBREVIATIONS AND ACRONYMS

AG	Attorney General
AGI	Association of Ghana Industries
AMCEN	African Ministerial Conference on Environment
ATL	Akosombo Textiles Limited
AU	African Union
BAT	Best Available Technique
BCF	Bioconcentration Factor
BECE	Basic Education Certificate Examinations
BEP	Best Environmental Practice
BOST	Bulk Oil Storage and Transport
CAS	Chemical Abstract Service
CBO	Community Based Organisation
CCMC	Chemicals Control and Management Centre
CEG	Criteria Expert Group
CEPS	Customs Excise and Preventive Service
CIEN	Chemical Information Exchange Network
COP	Conference of Parties
COCOBOD	Ghana Cocoa Board
CRIG	Cocoa Research Institute of Ghana
CSIR	Council for Scientific and Industrial Research
DA	District Assembly
DANIDA	Danish International Development Agency
DDD/ DDE	Metabolites of Dichlorodiphenyltrichloroethane
DDT	Dichlorodiphenyltrichloroethane
DEMC	District Environmental Management Committees
DVLA	Driver and Vehicle Licensing Authority
EAP	Environmental Action Plan
EC	Emulsifiable Concentrate
ECG	Electricity Company of Ghana
ECOG	Evergreen Club of Ghana
ECOLAB	Ecological Laboratory of University of Ghana
ECOWAS	Economic Community of West African States

EIA	Environmental Impact Assessment
ELISA	Enzyme Linked Immunosorbent Assay
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
ESM	Environmentally Sound Management
FAO	Food and Agriculture Organisation of the United Nations
FCUBE	Free Compulsory Universal Basic Education
FDB	Food and Drugs Board
FOE	Friends of the Earth – Ghana
GAEC	Ghana Atomic Energy Commission
GBC	Ghana Broadcasting Corporation
GDP	Gross Domestic Product
GEF	Global Environment Facility
GES	Ghana Education Service
GTV	Ghana Television
GHAFF	Ghana National Association of Farmers and Fishermen
GHANED	Ghana Environmental Database
GHS	Ghana Health Service
GNFS	Ghana National Fire Service
GNPC	Ghana National Petroleum Corporation
GRATIS	Ghana Regional Appropriate Technology Information Service
GSB	Ghana Standards Board
GTZ	German Technical Co-operation
GWCL	Ghana Water Company Limited
HCB	Hexachlorobenzene
IARC	International Agency for the Research on Cancer
IFCS	Intergovernmental Forum on Chemical Safety
IIR	Institute of Industrial Research
INC	International Negotiating Committee
IOMC	Inter-Organisation Programme for the Sound Management of Chemicals
ISD	Information Services Department
I-TEQ	International Toxicity Equivalence
KAPB	Knowledge, Attitudes, Practices and Behaviour
KATH	Komfo Anokye Teaching Hospital

KNUST	Kwame Nkrumah University of Science and Technology
K_{ow}	Octanol/Water Partition Coefficient
LC ₅₀	Lethal Concentration 50
LD ₅₀	Lethal Dose 50
LI	Legislative Instrument
LPG	Liquefied Petroleum Gas
MCT	Ministry of Communication and Technology
MDAs	Ministries, Departments and Agencies
MEA	Multi-lateral Environmental Agreement
MOPSD-PSI	Ministry of Private Sector Development and President’s Special Initiative
MOI	Ministry of Information
MLGRD&E	Ministry of Local Government and Rural Development and Environment
MOFA	Ministry of Food and Agriculture
MOTI	Ministry of Trade and Industry
MP	Member of Parliament
MSDS	Material Safety Data Sheet
MSTQA	Metrology, Standards, Testing and Quality Assurance
MWRWH	Ministry of Water Resources Works and Housing
NBSSI	National Board for Small Scale Industries
NCT	National Coordinating Team
NEPAD	New Partnership for Africa’s Development
NGO	Non Governmental Organisation
NIP	National Implementation Plan
NLCD	National Liberation Council Decree
NMIMR	Noguchi Memorial Institute for Medical Research
NOEC	No Observable Effect Concentration
NRC	National Redemption Council Decree
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo- <i>p</i> -dioxins
PCDFs	Polychlorinated dibenzofurans
PCP	Pentachlorophenol
PIC	Prior Informed Consent
PNDCL	Provisional National Defence Council Law
POPs	Persistent Organic Pollutants

POPROC	Persistent Organic Pollutants Review Committee
PPM	Parts Per Million
PPRSD	Plant Protection and Regulatory Services Directorate
PSCE	Parliamentary Select Committee on the Environment
PSI	President’s Special Initiative
SES	Safe and Environmentally Sound
TCDD	Tetrachlorodibenzo- <i>p</i> -dioxin
TDI	Tolerable Daily Intake
TEQ	Toxicity Equivalents
TOR	Tema Oil Refinery
UG	University of Ghana
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
UNITAR	United Nations Institute for Training and Research
USA	United States of America
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
VALCO	Volta Aluminium Company
VRA	Volta River Authority
WHO	World Health Organisation
WRI	Water Research Institute



TABLE OF CONTENTS

ACKNOWLEDGEMENTS	2
FOREWORD	3
ABBREVIATIONS AND ACRONYMS.....	5
TABLE OF CONTENTS	10
LIST OF BOXES.....	12
LIST OF MAPS AND FIGURES.....	13
LIST OF ANNEXES	13
EXECUTIVE SUMMARY	14
CHAPTER ONE - INTRODUCTION.....	26
1.0 CONTEXT AND BACKGROUND: PERSISTENT ORGANIC POLLUTANTS, HUMAN HEALTH AND THE ENVIRONMENT	26
1.1 THE STOCKHOLM CONVENTION ON POPs: HISTORICAL PERSPECTIVES, OBJECTIVES AND COUNTRY OBLIGATIONS	26
1.1.1 <i>Historical Perspectives</i>	26
1.1.2 <i>Objective of the Convention</i>	27
1.1.3 <i>Convention Provisions</i>	27
1.2 THE “DIRTY DOZEN”: DEFINITIONS AND PROPERTIES	29
1.2.1 <i>Pesticides</i>	29
1.2.2 <i>Industrial Compounds</i>	33
1.2.3 <i>Unintended By-Products</i>	33
1.3 PREPARATION OF NIP: MECHANISM AND STAKEHOLDER CONSULTATION PROCESS	34
1.3.1 <i>Purpose and Structure of NIP</i>	34
1.3.2 <i>General Principles</i>	35
1.3.3 <i>Summary of NIP Preparatory Phases</i>	35
1.3.4 <i>Stakeholder Participation</i>	36
CHAPTER 2: COUNTRY BASELINE INFORMATION.....	38
2.0 INTRODUCTION	38
2.1 COUNTRY PROFILE.....	38
2.1.1 <i>Geography and Population</i>	38
2.1.2 <i>Political and Economic Profile</i>	43
2.1.3 <i>Profiles of Economic Sectors</i>	44
2.1.4 <i>Environmental Overview</i>	47
2.2 INSTITUTIONAL, POLICY AND REGULATORY FRAMEWORK	48
2.2.1 <i>Environmental Policy, Sustainable Development Policy and General Legislative Framework</i>	48
2.2.2 <i>Roles and Responsibilities of Ministries, Agencies and other Governmental Institutions Involved in POPs Life-cycles (from source to disposal, environmental fate and health monitoring)</i>	49
2.2.3 <i>Relevant International Commitments and Obligations</i>	51
2.2.4 <i>Description of Existing Legislation and Regulations addressing POPs (manufactured chemicals and unintentionally produced POPs)</i>	51
2.3 <i>Key Approaches and Procedures for POPs Chemicals and Pesticides Management including Enforcement and Monitoring Requirements</i>	54
2.4 ASSESSMENT OF THE POPs ISSUE IN GHANA	60
2.4.1 <i>Assessment with Respect to Annex A, Part I chemicals (POP pesticides)</i>	60
2.4.2 <i>Assessment With Respect to Annex A, Part II Chemicals (Polychlorinated Biphenyls)</i>	62
2.4.3 <i>Assessment With Respect to Annex B Chemicals (DDT)</i>	63

2.4.4	<i>Assessment of Releases from Unintentional Production of Annex C Chemicals (PCDDs/PCDFs, HCB and PCBs)</i>	65
2.4.5	<i>Information on State of Knowledge on Stockpiles, Contaminated Sites and Wastes, Identification, Likely Numbers, Relevant Regulations, Guidance, Remediation Measures, Data on Releases from Sites</i>	68
2.4.6	<i>Summary of Future Production, Use and Releases of POPs – Requirements for Exemptions</i>	74
2.4.7	<i>Existing Programmes for Monitoring of Releases, Environmental and Human Health Impacts, Including Findings</i>	76
2.4.8	<i>Current Level of Information, Awareness and Education among Target Groups; Existing Systems to Communicate Such Information to the Various Groups; Mechanism for Information Exchange with Other Parties to the Convention</i>	79
2.4.9	<i>Relevant Activities of Non-Governmental Stakeholders</i>	84
2.4.11	<i>Identification of Impacted Populations or Environments, Estimated Scale and Magnitude of Threats to Public Health and Environmental Quality and Social Implications for Workers and Local Communities</i>	88
2.4.12	<i>Details of any Relevant System on Assessment and Listing of New Chemicals</i>	89
2.4.13	<i>Details of Any Relevant System on Assessment and Regulation of Chemicals Already in the Local Market</i>	89
CHAPTER 3: STRATEGY AND ACTION PLAN ELEMENTS OF THE NATIONAL IMPLEMENTATION PLAN		90
3.0	INTRODUCTION	90
3.1	POLICY STATEMENT.....	90
3.2	IMPLEMENTATION STRATEGY	91
3.2.4	<i>Institutional/Organisational Arrangements and Assignment of Responsibilities</i>	93
3.2.5	IMPLEMENTATION APPROACH.....	93
3.3	ACTIVITIES, STRATEGIES AND ACTION PLANS	94
3.3.1	<i>Activity: Institutional and Regulatory Strengthening Measures</i>	94
3.3.2	<i>Activity: Measures to Reduce or Eliminate Releases from Intentional Production and Use</i>	95
3.3.3	<i>Activity: Production, Import and Export, Use, Stockpiles and Wastes of Annex A POPs Pesticides (Annex A, Part I Chemicals)</i>	95
3.3.4	<i>Activity: Production, Import and Export, Use, Identification, Labelling, Removal, Storage and Disposal of PCBs and Equipment Containing PCBs (Annex A, Part II chemicals)</i>	95
3.3.5	<i>Activity: Production, Import and Export, Use, Stockpiles and Wastes of DDT (Annex B Chemicals) if used in country. (See also 3.3.2 and 3.3.1 Activity 4)</i>	95
3.3.6	<i>Activity: Register for Specific Exemptions and continuing need for Exemptions (Article 4)</i>	96
3.3.7	<i>Activity: Measures to Reduce Releases from Unintentional Production (Article 5)</i>	96
3.3.8	<i>Activity: Measures to Reduce Releases from Stockpiles and Wastes (Article 6)</i>	96
3.3.9	<i>Strategy: Identification of Stockpiles, Articles in Use and Wastes</i>	96
3.3.10	<i>Activity: Measures to Manage Stockpiles and Appropriate Measures for Handling and Disposal of Articles in Use</i>	96
3.3.11	<i>Strategy: Identification of Contaminated Sites (Annex A, B and C Chemicals) and Remediation in an Environmentally Sound Manner</i>	96
3.3.13	<i>Activity: Effectiveness Evaluation (Article 16)</i>	97
3.3.14	<i>Activity: Reporting</i>	97
3.3.15	<i>Activity: Research, Development and Monitoring (Article 11)</i>	97
3.3.16	<i>Activity: Technical and Financial Assistance (Articles 12 and 13)</i>	97
3.4	DEVELOPMENT AND CAPACITY BUILDING PROPOSALS AND PRIORITIES	97
3.5	TIMETABLE FOR PLAN IMPLEMENTATION AND MEASURES OF SUCCESS	98

LIST OF TABLES

	Page	
Table 1	Roles and Responsibilities of Relevant Institutions Related to Chemicals Management	49
Table 2	Chemicals- Related MEAs and their Ratification Status for Ghana	51
Table 3	Status of POPs in Ghana	53
Table 4	Previous Uses of POPs Pesticides in Ghana	61
Table 5	Imports of Hexachlorobenzene and DDT	64
Table 6	Potential Main Source Categories of PCDDs and PCDFs in Ghana	65
Table 7	Projected POPs Production, Use and Unintentional releases	74
Table 8	Responsibility Assignment Matrix	94
Table 9	Timetable for Plan Implementation and Measures of Success	98
Table 10	Resources Required for the Successful and Effective Implementation of the Identified Tasks and Activities	99
Table 11	Institutional and Regulatory Strengthening Measures	101
Table 12	Measures to Reduce or Eliminate Releases from Intentional Production and Use	102
Table 13	Production, Import and Export, Use, Stockpiles and Wastes of Annex POPs Pesticides (Annex A, Part I Chemicals)	103
Table 14	Production, Import and Export, Use, Identification, Labelling, Removal, Storage and Disposal of PCBs and Equipment Containing PCBs (Annex A, Part II chemicals)	103
Table 15	Production, Import and Export, Use, Stockpiles and Wastes of DDT (Annex B Chemicals).	105
Table 16	Register for Specific Exemptions and the Continuing need for Exemptions (Article 4)	106
Table 17	Measures to Reduce Releases from Unintentional Production (Article 5)	107
Table 18	Measures to Reduce Releases from Stockpiles and Wastes (Article 6).	111
Table 19	Identification of Stockpiles, Articles in Use and Wastes	112
Table 20	Measures to Manage Stockpiles and Appropriate Measures for Handling and Disposal of Articles in Use	113
Table 21	Identification of Contaminated Sites (Annex A, B and C Chemicals) and Remediation in an Environmentally Sound Manner	113
Table 22	Facilitating or undertaking Information Exchange and Stakeholder Involvement	114
Table 23	Public awareness, information and Education (Article 10)	115
Table 24	Effectiveness Evaluation (Article 16)	116
Table 25	Reporting	117
Table 26	Research, Development and Monitoring (Article 11)	120
Table 27	Technical and Financial Assistance (Articles 12 and 13)	121
Table 28	Development and Capacity Building Proposals and Priorities	122

LIST OF BOXES

	Page	
Box 1:	Article 7 of the Stockholm Convention (Implementation Plans)	34
Box 2:	General Guiding Principles for NIP development	35

LIST OF MAPS AND FIGURES

	Page
Map 1: Location Map of Ghana	38
Map 2: Map of Ghana showing Annual Rainfall	39
Map 3: Map of Ghana Showing Topography	41
Map 4: Map of Ghana Showing Soil Types	42
Map 5: Map of Ghana showing Administrative Regions	43
Map 6: Map of Ghana Showing Poverty Incidence	45
Figure 1: Annual Releases of PCDDs and PCDFs in Ghana for 2002 (gTEQ/a)	66

LIST OF PLATES

	Page
Plate 1: A contaminated site: Immediate environ of a transformer contaminated by spillage	69
Plate 2: Technicians of the Electricity Company of Ghana at work in the transformer repair building	70
Plate 3: Drains around repair building choked with black contents of transformers	71
Plate 4: Displayed reservoir for PCB/oil waste at the Accra Central Power Station G	72
Plate 5: Decommissioned and disconnected capacitors stored at capacitor banks at Achimota	73
Plate 6: Capacitors broken at the insulator end or bulging out on the sides	73

LIST OF ANNEXES

Annex I: Schematic Representation of the NIP Process
Annex II: Pesticides Control and Management Act, 1996 (Act 528)
Annex III: Details of Sub-Categories of Sources of PCDD/PCDF in Ghana
Annex IV: Draft National Environmental Quality Standards Regulations
Annex V: List of Active NGOs Registered with the Environmental Protection Agency
Annex VI: List of National Stakeholders
Annex VII: Main Proposals and Priorities

EXECUTIVE SUMMARY

Introduction

Persistent Organic Pollutants (POPs) are highly toxic substances released into the environment through human activity. They cause an array of adverse effects, notably, diseases and birth defects among humans and animals.

Aware that POPs pose major and increasing threat to human health and the environment, in May 1995, the Governing Council of the United Nations Environment Programme (UNEP) requested in its decision 18/32 that an international assessment process be undertaken of an initial list of 12 POPs (the so-called “dirty dozen”). These are: aldrin, chlordane, DDT, dieldrin, dioxins, endrin, furans, hexachlorobenzene, heptachlor, mirex, PCBs and toxaphene.

An Inter-Governmental Negotiating Committee (INC), mandated to prepare an international legally binding instrument for implementing international action started its work in June 1998 in Montreal, Canada, and concluded in Johannesburg, South Africa, in December 2000. The INC also established an expert group to develop criteria and a procedure for identifying additional POPs as candidates for future international action as well as a number of immediate actions to address POPs.

The Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted and opened for signature at a Conference of Plenipotentiaries held from 22 to 23 May 2001 in Stockholm, Sweden. Ninety-two (92) States and the European Community signed the Convention at a ceremony in Stockholm on 23 May 2001. The Stockholm Convention entered into force on 17 May 2004, 90 days after the submission of the fiftieth instrument of ratification.

Ghana signed and adopted the Convention on 23 May 2001 in Stockholm, Sweden, and ratified it on 30 May 2003.

Objective of the Stockholm Convention

The objective of the Stockholm Convention is to protect human health and the environment from persistent organic pollutants. This is consistent with the precautionary approach set forth in Principle 15 of the Rio Declaration on Environment and Development.

Preparation of National Implementation Plans

Article 7 of the Stockholm Convention on POPs requires Parties to prepare National Implementation Plans (NIPs). A National Implementation Plan is a formal planning document, which defines a country's commitments, current situation and actions it plans to undertake in the fields of POPs management. Elements of Article 7 include the following:

- Transmission of implementation plan to the Conference of the Parties within two years of the date on which the Convention enters into force
- Review and update, as appropriate, implementation plans on periodic basis as specified by a decision of the Conference of the Parties
- Cooperating directly or through global, regional and sub-regional organizations, and consultation of national stakeholders, including women's groups and groups involved in health of children, in order to facilitate the development, implementation and updating of their plans.

- Establishing the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate.

Ghana's Commitment to Implement POPs National Implementation Plan

Sound Chemicals Management in Ghana

Ghana, through the Environmental Protection Agency has been playing a lead role in promoting safe management of chemicals (including POPs) for industrial, agricultural, public health and consumer uses in order to avoid damage to human health, the ecosystems, and the environment in general. Sound management of chemicals also promotes sustainable development.

As a first step, a national profile for the sound chemicals management was prepared in 1997. The profile provides a comprehensive assessment of the national chemicals management infrastructure relating to the legal, institutional, administrative and technical aspects, along with an understanding of the nature and extent of chemicals availability and use. A national action programme for an integrated chemicals management in Ghana was also initiated in 1997.

Relevant International Commitments and Obligations

Ghana supports international efforts towards sound management of chemicals and participated fully during the negotiations of all the existing chemicals-related Multi-lateral Environmental Agreements (MEAs) and Programmes including:

- The Rotterdam Convention on Prior Informed Consent (PIC) Procedure of certain Pesticides and Chemicals in International Trade (1998);
- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)
- Bamako Convention on the Control of Transboundary Movements of Hazardous Wastes (1991)
- FAO International Code of Conduct for the Distribution and Use of Pesticides (as amended in 2003)
- ILO Convention on the Safety of Chemicals at the Workplace (1990)
- The UN Convention on Substances that Deplete the Ozone Layer (Vienna Convention) (1985)
- Montreal Protocol on Substances that Deplete the Ozone Layer (1987)
- London Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer (1990)
- UN Chemicals Weapons Convention (1993)
- The provisions of the Rio Declaration on Environment and Development and Agenda 21 (1992).

Apart from the Bamako Convention all the above Conventions have been ratified and steps are being taken to implement them at the country level.

Assessment of the POPs Issues in Ghana

Preliminary inventories were carried out in 2003 to ascertain the status of POPs in Ghana in order to facilitate early action on the implementation of the Stockholm Convention. The inventories revealed the following.

Assessment of Institutional, Policy and Regulatory Framework for the Sound Management of POPs

There is a policy or regulatory framework for the management of potentially bioaccumulative and toxic substances, which include POPs in Ghana. The framework is however inadequate and incapable of dealing with the specific requirements of the Stockholm Convention on POPs. It may have some

relevance but not necessarily aimed at the management or elimination of POPs. There is therefore the need for a comprehensive policy and regulatory framework to deal with all chemicals.

There are a number of laws that have some relevance to the POPs listed in the Convention. Many of these laws however, do not address the dangers posed to humans and the environment by the chemicals in question. Where they may be relevant, the institutions that deal with them do not have the resources to monitor or research into their disposal as required by the Convention. The existing laws are listed under section 2.2.4 in the main text.

The Pesticides Control and Management Act, 1996 (Act 528) is the only legislation that addresses the importation, manufacture, formulation, distribution, use and transportation of pesticides in Ghana. The POPs that are not considered as pesticides are however, not covered by the Act. Public awareness of the requirements of these laws is also low and compliance is consequently at a minimum.

A framework exists for multi-sectoral collaboration in the control and management of chemicals in the country. With the EPA as the coordinating institution, Ministries, Departments and Agencies (MDAs) such as the Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture, the Ghana Standards Board, the Ghana Atomic Energy Commission, the Customs, Excise and Preventive Service, the Minerals Commission, the Ministry of Health/Ghana Health Service, the Food and Drugs Board, NGOs and the universities and research institutions participate in committee meetings aimed at sound chemicals management in the country.

In addition to the numerous uncoordinated pieces of legislation and regulations, there are also a number of identified institutions whose activities impinge on POPs management, regulation and enforcement. Each of these institutions has either/or a combination of usage, management or regulatory functions. Their functions are often not coordinated, with some institutions experiencing conflicts in the execution of duties leading to duplication of efforts, gaps in regulation and control and waste of resources.

As required by its Policy Statement on the Environment, the Government of Ghana is expected 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”.

The above expectation from government has necessitated the need for a more comprehensive policy on toxic substances (including POPs) for the country. There are currently 17 existing chemical-related legislations in Ghana. Although these laws are not specific to the POPs, they provide a framework for the management of all chemicals and pesticides, which includes POPs.

Assessment of Annex A, Part I Chemicals (POPs Pesticides)

A preliminary inventory of Annex A, Part I chemicals (aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex and toxaphene) in Ghana showed that there are presently no reliable official records on production, import, export, and use of POPs pesticides in Ghana. Though some evidence exist that there has been an unofficial importation and use of HCB in recent times, the source, destination and quantities could not however be ascertained due to lack of proper monitoring to track down illegal importations into the country. Unspecified quantities of stockpiles and waste of Annex A, Part I Chemicals and their locations have not been reliably established.

Analytical investigations of organochlorine pesticides in organs of human body and fluids have been conducted by the forensic science laboratory of the Ghana Standards Board in collaboration with the Department of Pathology at the University of Ghana Medical School. This and other reported incidents suggest that some of the organochlorine pesticides are still in use illegally and might include Annex A Part I Chemicals. Residues of POPs pesticides (Annex A Part I Chemicals) as a result of intensive past application may still be present in the environment. There are currently no specialized laws that control and manage POPs pesticides in Ghana, but are partially dealt with under the Pesticides Control and

Management Act, 1996 (Act 528). There is collaboration among the EPA, CEPS, and PPRSD in the importation, monitoring and application of pesticides in general.

Assessment of Annex A, Part II Chemicals (Polychlorinated Biphenyls and Polychlorinated Biphenyls-Containing Equipment)

Available information indicates that there is no production of PCBs in Ghana. PCB applications by location include, electric utilities (including distribution networks), industrial facilities, residential and commercial buildings, etc. In Ghana, the main potential PCB-containing applications at the target locations were found to be transformers and capacitors (closed applications).

There is enough evidence to suggest that workers in some industries have been exposed to PCBs as a result of bad practices such as the use of empty transformer oil drums as water reservoirs. PCBs oils referred to as ‘dirty oil’ finds its way into small-scale industries where it is used to produce pomade and sold on the local markets for other application and purposes.

The Electricity Company of Ghana (ECG) as well as the Volta River Authority (VRA) and their clients (individual customers and industry) are the major custodians of PCB-containing equipment in Ghana. Available information indicates that the ECG officially ceased importing PCB-containing transformers and capacitors for use in Ghana in 1972.

Plasticizers constitute the largest source (open applications) of PCBs releases in Ghana. Other open applications may include certain paints, fire retardants and lubricants. There are however no statistics on national imports (including quantities and types) to allow the estimation of potential volumes of such uses.

The preliminary inventory carried out in 2003 revealed that there are about 455 pre-1972 possible PCB-containing transformers (11kV and 33kV) found country-wide. One hundred and forty-seven (147) pieces of possible PCB-containing capacitors were found at the Achimota and Tema power stations. It has been found that the importation and use of closed, semi-closed and open applications equipment in the country are not properly monitored and documented. There is the possibility that the post –1972 transformers may also contain significant amounts of PCBs as a result of, for example, refilling with possible PCB-contaminated mineral oils.

PCB- containing wastes were found at the Accra Central Station G- and the VRA materials stores at Tema. These are primary stations where broken down transformers from all over the country are repaired.

Assessment of Annex B Chemicals (DDT)

DDT had been used extensively in Ghana in the past both for agriculture and public health purposes. The Ministry of Food and Agriculture, the Ghana Cocoa Board and the Ministry of Health appear to be the major importers of DDT before it was officially banned in 1985. DDT was officially used in agriculture as the main insecticide against cocoa capsids and for malaria and filariasis control programmes by the Ghana Cocoa Board and Ministry of Health respectively. There is general paucity of data on DDT import and application in Ghana. There is also no information on export of any kind.

Information gathered from the Ghana Statistical Service indicates that there had been some unofficial importation of hexachlorobenzene and DDT into the country in the recent past. The source, however, could not segregate the quantities into hexachlorobenzene and DDT. It could also be attributed to the fact that there was no proper monitoring in place to track down those quantities and other illegal importations into the country as the companies that imported the consignments also could not be identified.

Since DDT was phased out, alternatives including Lindane (Gamma-HCH) and Uden (Propoxur) were used in the cocoa sector. Currently Lindane (Gammalin 20EC) and Uden have been replaced with safer alternatives including Confidor 200SL (Imidachloprid) and Akate Master (Bifenthrin). In the food crop sector, pesticides including Dursban (Chlorpyrifos) and Fipronil have replaced the organochlorines.

Assessment of Releases from Unintentional Production of Annex C Chemicals (PCDDs/PCDFs, HCB and PCBs)

The main potential source categories of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs), also known as dioxins and furans, present in Ghana have been identified as follows:

- Uncontrolled combustion processes
- Medical waste incineration
- Power generating and heating
- Ferrous and non-ferrous metal production
- Mineral production
- Disposal/Landfilling
- Transport
- Production and use of chemicals and consumer goods

The emissions of dioxins and furans to air, water and residue, for the main sources categories listed below have been assessed. Uncontrolled combustion processes, medical wastes incineration, power generation/heating and transport (particularly in the urban areas where vehicular traffic is a problem) were found to be the main sources of PCDDs/PCDFs in Ghana, for which also the most reliable data are available.

Uncontrolled combustion processes (particularly indiscriminate bush fires) were identified as the major source of PCDDs/PCDFs in Ghana in 2002. For an estimated total of 386 g TEQ of PCDDs/PCDFs emitted from known sources to air in the year 2002, the sector of uncontrolled combustion processes released a total of 371.2 g TEQ to air, corresponding to 96.2 % of the total emissions to air. Within the sector of uncontrolled combustion processes, emissions to air due to indiscriminate burning of forest fires, savannah grasslands and waste dumps were 218 g TEQ and 129 g TEQ and 24.2 g TEQ constituting 58.7 %, 34.8 % and 6.5 % respectively. The remaining amount of releases (14.8 g TEQ) from the main sources of PCDDs/PCDFs in 2002 was due to releases from power generation, medical waste incineration, transport and miscellaneous sources such as crematoria.

Additionally, an estimated total of 279 g TEQ of PCDDs/PCDFs was released from uncontrolled combustion processes to land in 2002. The breakdown for these emissions to land in 2002 was 175 g TEQ (62.3 %) from forest fires and 103 g TEQ (37.7 %) resulting from savannah grassland fires.

Indiscriminate waste oil discharges, household cooking and heating, and open water dumping are other potential sources of releases of dioxins and furans in Ghana.

Releases of HCB and PCBs could not be assessed due to unavailability of reliable data at the time of the inventorisation.

Preliminary Assessment of Stockpiles of POPs Pesticides, POPs Contaminated Sites and Wastes

Results obtained from the countrywide inventory carried out in 2003 did not record any stockpiles of POPs pesticides (Annex A Part I and Annex B Chemicals). However, there are unconfirmed reports of volumes of pesticides containers, which were buried at the premises of the Plant Protection and Regulatory Services Directorate (PPRS) at Pokuase in the Ga District of the Greater Accra Region as

well as at the Tono and Veve Irrigation sites in the Upper East Region. It is alleged that the pesticide containers were buried in the early 1970's. There is therefore the probability that these containers might include POPs pesticides (Annex A Part I and Annex B Chemicals). Further work is required to investigate the issue and possibly locate the area and number of containers in order to carry out chemical analysis for identification purposes. This will also pave way for future work on evaluation of the extent of contamination and possible re-mediation.

The results of an earlier inventory carried out by PPRSD as part of an FAO stockpile/obsolete pesticides project in 2000 indicates that there are seventy-two (72) metric tons of stockpiles/obsolete pesticides in Ghana. In this survey, a number of the pesticides could not be identified due to lack of labeling, conditions of the chemicals in question and the absence of a requisite analytical laboratory. The probability that these products may include POPs pesticides (Annex A Part I and Annex B Chemicals) cannot be ruled out. To avoid possible cross contamination, all obsolete pesticides stockpiles and wastes will be analyzed for POPs content. Sites where the stockpiles are stored will require investigation for possible soil and ground water contamination.

Potential sources of POPs contaminated sites in Ghana include:

- Immediate surroundings of all in-use transformers;
- Locations where electrical equipment (particularly transformers and capacitors) were serviced;
- Areas where spillages occurred during the filling of such equipment with PCBs;
- Poorly designed and maintained storage sites;
- Locations where POPs wastes were/are dumped;
- Waste discharges from chemical plants, where elemental chlorine is involved in the technology;
- Sewage sludge treatment plants; and
- Former organochlorine pesticides manufacturing/formulation plants.

The priority areas of concern include the following:

- The immediate surrounding areas of the pre-1972 transformers countrywide;
- The Electricity Company of Ghana Accra Central Station G (Makola) and its environs;
- Municipal waste dumps countrywide;
- Open water discharges in main industrial cities and towns;
- Pesticides contaminated sites including the premises of the PPRSD/MoFA, Pokoase in the Greater Accra Region, Abuakwa Formulation Plant, Kumasi in the Ashanti Region as well as the Veve and Tono Irrigation sites in the Upper East Region; and
- Areas where obsolete stockpiles of pesticides and pesticides waste are being stored

Available evidence indicates that the dirty oil reservoir at the Accra Central Station G due to lack of proper monitoring are unofficially and illegally sold out to:

- Enterprising women who illegally use the oil or possibly PCBs to formulate beauty creams for sale on the open market ;
- Welders for use in welding machines;
- People who apply them as lubricants in domestic sewing machines; and
- Other entrepreneurs who mix it with sawdust for industrial and domestic use as fuel.

Preliminary Assessment of the Extent of Exposure of the Human Population (Especially Vulnerable Groups) and the Environment to POPs

A review of the extent of exposure of the human population and environment in Ghana to POPs was carried out. The inventory covered the extent to which POPs is an issue in Ghana with regard to production, use, emission, to assess human exposure particularly that of vulnerable groups.

A number of reviews, evaluations and assessments of POPs sources, regulations on their uses, situational analysis in Ghana of POPs in terms of their lifecycles; their presence in the environment, food, feed and humans; national monitoring capacity and vulnerable groups at risk and those with a potential risk of exposure to POPs; environmentally sensitive areas to POPs emissions, hot spots and contaminated sites have been documented..

It was realized that no institution or organization has been mandated to monitor POPs in the environment, food, feed and humans, though some organizations may deal with some aspect of this, especially in analysis, in the course of their work. No institution also monitors the presence of POPs Pesticides, industrial POPs, dioxins and furans.

Potential risk groups are those who may be exposed occupationally and non-occupationally. Occupationally, the risk group include,

- Workers from the small scale aluminium smelting companies who rely on scrap metals as raw materials for production.
- Casual workers employed to work at waste dump sites.
- Casual workers involved in asphalt mixing during road construction.
- Personnel at the petroleum refinery exposed to leaded fuel and also at the fuel dispensers.
- Fish smokers employing polished timber as fuel wood
- Farmers engaged in agricultural production where the use of pesticides is not regulated.
- Technicians responsible for the servicing and maintenance of PCB-containing transformers and capacitors.

The non-occupational group includes the general public exposed to emissions from open burning of waste, domestic and industrial fires, bush burning and vehicular emissions.

It is estimated that, from these and many other potential risk groups, over half of the population of Ghana may be directly or indirectly exposed to POPs, aggravating the threat of health related issues and decline in environmental quality. These have both social and health implications for workers and local communities.

Exposures in both cases are either accidental or deliberate. However, these could be prevented to a large extent by the institution of safe systems of work and the use of appropriate personal protective equipment. The use of personal protection equipment is very limited among agricultural workers. This may either be due to lack of knowledge on its significance or sheer recalcitrance. The same can be said for transportation, storage and disposal of chemicals and their containers after use. Medical surveillance among POPs users needs to be researched into. Employers should be sensitized to provide routine medical examinations for their employees. In areas of dioxin and furan releases, vulnerable groups are taking no special precautions. There is therefore an urgent need for sensitization at both the individual and institutional levels if preventive measures are to be effective.

The gaps identified can be bridged by putting in place measures to increase public education and raise awareness. Encouragement of research in grey areas, training of specialists, conducting of studies on

health effects of those exposed and the general public. Priority areas that need urgent attention include the following:

- Training of specialists in clinical toxicology to strengthen the management of poisoning cases in the health institutions and poison centers;
- A well-equipped national accredited laboratory, which can analyze and detect samples to the minutest detail possible.

Technical and Infrastructural capacity for POPs Assessment, Measurement, Analysis, Alternatives and Prevention Measures Management, Research and Development

Waste management systems in the country are underdeveloped. There are inadequate sanitary landfills for the proper disposal of waste of all categories. Most categories of waste are collected in a largely uncoordinated manner and deposited at dumpsites and left to naturally rot or in some cases burnt. The numerous waste dumps scattered all over the country is evident of the level of the magnitude of the problem of poor waste management in Ghana.

In Ghana the infrastructure and capability for the remediation of contaminated sites are underdeveloped. There is therefore the need to build capacities and develop the requisite infrastructure to manage contaminated sites in the country. Relevant national stakeholder institutions have a major role to play in the development of capacity for contaminated sites management, including remediation. The roles that would be played by such institutions within the framework of NIP implementation would include:

- Enhancement of their capabilities for the assessment of POPs contaminated sites and remediation;
- Research on appropriate scientific methods for identification of contaminated sites and guidelines for remediation;
- Provision of information on Best Available Techniques (BAT) and Best Environmental Practices (BEP) for POPs contaminated sites remediation.

Monitoring of POPs in the environment, food, feed and humans is virtually non-existent in the country. A number of institutions, though not concerned primarily with the monitoring of POPs in the environment, have been identified to deal with pesticide analysis in the course of their work.

Currently there are no specific programmes for monitoring the effects of POPs on human health. This is due, among other things, inadequate personnel and facilities required to effectively monitor the effects and assess the impact of POPs on the population. There is therefore the need to train health personnel in particular and other related institutions and equip existing laboratories to carry out proper assessment of POPs on human health on a continuous basis.

A situational analysis conducted on the monitoring, research and development capacity of the various institutions in the country indicated that the chemical effects of POPs on economic, social and health activities are quite well known. However it is difficult to assess the institutional capacity to deal with the problems that may arise in terms of monitoring, research and development of its human and material resources. A number of academic and research institutions in Ghana with the potential to develop and to meet such challenges have been identified. These institutions have similar and basic problems including inadequate facilities, personnel and infrastructure required for effective research and development. There is therefore the need to resource the institutions to enable them undertake local research and development and also contribute to the ongoing Global Monitoring Programme on POPs towards the effectiveness evaluation as required under Article 16 of the Convention.

The EPA has initiated the process of developing a comprehensive chemicals information management system to assist in sound chemicals management including POPs. The information system would be

networked with relevant public and private institutions to facilitate the exchange of information on chemicals and to make the systems easily accessible to the general public. This system will serve as the national focal point for the exchange of information and a clearinghouse mechanism for information on POPs as required under Article 9 of the Convention.

A number of human and institutional capacity gaps have been identified. These include:

- Inadequate experts with the requisite qualifications to regulate and manage POPs; and
- Inadequate financial resources to acquire the equipment and logistics (e.g. chemicals and other consumables) necessary to carry out experiments and monitor activities related to POPs.

Assessment of Current Level of Information, Public Awareness and Education and System of Communication among Target Groups

In according to Ghana's Environmental Action Plan, continuous and detailed education programmes are being implemented at all levels of the society so that every Ghanaian becomes aware of the problem and fully assumes responsibility in safeguarding the environment. In the formal system, Environmental Education has been integrated into the curriculum of schools. In the non-formal system, sustained efforts are being made to promote awareness among policy makers to provide training for resource managers at appropriate levels, and promote greater public awareness and motivation for environmental action. Some of the institutions and organizations, which have the capacity for disseminating environmental and chemicals related information to the public, include the following:

- Non Governmental Organisations (NGOs) and Community Based Organisations (CBOs)
- Ghana Education Service
- District Assemblies
- Media
- Religious Organisations or Faith Based Organisations
- Universities and Research Institutions
- Traditional Institutions

There are specific practices by government and stakeholders in ensuring public awareness and education. The government public information policy and practice related to the environment have been embedded in various laws and legislation as well as the 1992 constitution. The major ones are Act 490, LI1652 and Act 528. Additionally, some institutional policies on the environment, forest, etc have been documented.

In the formal system, the EPA in collaboration with the Ministry of Education integrated Environmental Education into the syllabus of schools. Environmental themes/topics are therefore taught in schools and colleges. In the non-formal sector, the EPA conducts seminars, training, publishes reports on the environment, publishes newsletters and carries out environmental awareness campaigns to the general public including exhibitions.

There are specific tools, techniques and mechanisms for disseminating environmental and chemicals related information in some organizations and NGOs.

In Ghana there is enough evidence to suggest that best practice is very often not followed due to the general lack of knowledge and information on the potential hazards and risks of chemicals on human health and the environment and has led to mismanagement and misapplication. There is therefore the need to sensitise and educate the general population, especially end-users on the sound management of chemicals. An effective education and awareness programme will minimise the potential adverse impacts of chemicals on human health and the environment whilst maximising their benefit have been developed.

A public awareness, information and education programme has been outlined. The overall objective of this programme is to develop and implement effective information and communication strategy for the sound management of chemicals in Ghana.

National Priorities and Key Issues

The main priority areas of national concern have been identified as follows:

- i. Public education and awareness creation;
- ii. Monitoring, control and evaluation;
- iii. Development of new legislation, harmonizing of existing legislation;
- iv. Detailed inventory of POP chemicals and identification of hot spots;
- v. Capacity building towards the elimination of Polychlorinated Biphenyls in Ghana;
- vi. Capacity building towards the implementation of BAT and BEP guidelines for source reduction of POP emissions
- vii. Strengthening the institutional capacity in terms of legal, technical infrastructure and human resource (e.g. training of Customs Officers and Environmental Inspectors etc) to manage POPs;
- viii. Information Exchange and Networking;
- ix. Identification and management of contaminated sites including remediation, and
- x. Research into the extent of exposure of the population to POPs and the search for safer alternatives.

Stockholm Convention on POPs Implementation Strategy

The overall objective of sound management of POPs in Ghana is firstly to strengthen the national capacity and capability to deliver a comprehensive assessment of the threats posed by POPs to human health and the environment. It also seeks to reduce and ultimately eliminate POPs from the environment as envisaged under the Stockholm Convention on POPs.

Principles of Implementation

The National Implementation Plan will form an integral part of the national integrated chemicals management programme and the implementation strategy would be based on the following principles:

- Public and Stakeholder Participation

A coordinated approach will be adopted, with co-operation among all relevant stakeholders at all levels and all sectors. Responsibilities related to chemicals management as well as those involved in activities that influence chemical safety, including the private sector, industry, labour and public interest groups will be assigned. Women and children's groups in particular, will be empowered and encouraged to actively participate in the implementation of the NIP.

- Transparency in Information Sharing and Exchange

Data/Information will be collected and where necessary generated, especially those specific to the national or local situation and made available to the general public. National chemical databases will provide information on the amounts of chemicals imported, formulated and traded in the past and present. Clinical, epidemiological, and environmental data are needed to support decision-making as well as assess and manage risks under local conditions.

- Adherence to Polluter Pays Principle

Adequate legal, institutional, administrative and technical infrastructure will be pursued. This will help enforce regulatory provisions of the Convention including adherence to “the polluter pays principle”.

- Integration with Overall Environmental Management and Sustainable Development Policies

Implementation of the NIP is expected to contribute to the promotion of sound management of chemicals (including POPs) for industrial, agricultural, public health and consumer purposes in order to avoid damage to human health, the ecosystems, and the environment in general. This will ensure the attainment of sustainable development goals contained in the Ghana Environmental Action Plan.

- Adherence to and Use of Technologies and Applications of International Standards

The risk of POPs to human health and the environment will be assessed using internationally recognised criteria, standards and limits to the extent possible. Risk management based on sound principles and use of Best Available Techniques and Best Environmental Practices (BAT/BEP) will be applied.

- Commitments Regarding Public Awareness and Education

Efforts will be made to train and sensitise identified groups and the general public on POPs issues. An informed and aware population is recognised as vital in achieving public co-operation and confidence in POPs management.

- Adherence to International Requirements

Decisions concerning manufacture, formulation, import and use of individual and candidate POPs will be reassessed, periodically on a scheduled basis and in response to the availability of significant new information so as to meet international requirement including those of the EU. Research into alternative chemicals to POPs will be vigorously pursued.

Activities, Strategies and Action Plans

The national profile for chemicals management has been updated to include issues on the Stockholm Convention on POPs. Activities, strategies and action plans have been prepared to implement the country's obligations under the Stockholm Convention. Specific targets, milestones and performance indicators are outlined to allow progress of implementation to be reviewed and monitored.

Development and Capacity Building Proposals, Priorities and Targets for Implementation

Project proposals for the implementation of the strategies and action plans have been prepared. The overall goal of the projects is to improve the management of risks to human health and the environment from Persistent Organic Pollutants. The main proposals are as follows:

- Strengthening the human and institutional capacity for the management of POPs
- Development of capacity and capability for the identification, analysis and monitoring of POPs in the environment.
- Capacity building towards the elimination of Polychlorinated Biphenyls (PCBs) in Ghana;
- Development and implementation of information and communication system for the management of POPs.
- Investigation and assessment the nature and severity of health effects experienced by humans as a result of exposure to POPs.
- Safe and environmentally sound (SES) treatment and disposal of POPs, POPs-laden equipment and remediation of contaminated sites.

Resource Requirements

An initial assessment of resources and budgetary estimates needed for the successful and effective implementation of the NIP, have been identified. An initial framework for developing priority projects for the NIP has been outlined. This framework will take into consideration and identify specific human resources, stakeholder contributions and requirements for possible Global Environment Facility (GEF) incremental cost and funding by development/donor partners.

CHAPTER ONE - INTRODUCTION

1.0 Context and Background: Persistent Organic Pollutants, Human Health and the Environment

Over the past 50 years the world has conducted vast, uncontrolled, worldwide chemical experiments involving the oceans, air, soils, plants, animals, and human beings. The “Chemicals Revolution” has indeed contributed greatly to the welfare of human beings. Chemicals have increased crop yields by killing crop pests and have made possible an endless array of useful products. But once released into the environment, some chemicals despite their benefits produce toxic reactions, persist in the environment for years, travel thousand of kilometers from where they were used, and threaten long-term health and ecological consequences that were never anticipated or intended. One class of substances in particular, called Persistent Organic Pollutants (POPs), has aroused international concern. POPs are among the highly toxic pollutants released into the environment through human activity. They cause an array of adverse effects, notably, diseases, birth defects and death, among humans and animals. Specific effects can include cancer, allergies and hypersensitivity, damage to the central and peripheral nervous systems, reproductive disorders, and disruption of the immune system.

POPs act as powerful pesticides (e.g. DDT) and serve a range of industrial purposes (e.g. PCBs). Some POPs are also released as unintended by-products of combustion and industrial processes (e.g. PCDDs and PCDFs). While the risk level varies from POP to POP, by definition all of these chemicals share the following four properties:

- High toxicity: Short term and long term exposures of humans and the environment to POPs lead to detrimental adverse effects as a result of the inherent physical and chemical properties of the chemicals;
- Persistence: These highly stable compounds can last for years or even decades in the environment before breaking down or degrading into less dangerous forms;
- Potential for long-range environmental transport: They circulate globally through the various environmental compartments (air, water, soils, sediments) via a process known as the “*grasshopper effect*”;
- Bioaccumulation: POPs concentrate in living organisms; they are readily absorbed in fatty tissue, where concentrations can become magnified by up to 70,000 times the background levels. Fish, predatory birds, mammals, and humans are high up the food chain and so absorb the greatest concentrations.

1.1 The Stockholm Convention on POPs: Historical Perspectives, Objectives and Country Obligations

1.1.1 Historical Perspectives

Aware that POPs pose major and increasing threats to human health and the environment, the Governing Council of the United Nations Environment Programme (UNEP) in May 1995 requested in its decision 18/32 that an international assessment process be undertaken of an initial list of 12 POPs (aldrin, chlordane, DDT, dieldrin, dioxins, endrin, furans, hexachlorobenzene, heptachlor, mirex, PCBs and toxaphene). The Council also requested that the Intergovernmental Forum on Chemical Safety (IFCS) develop recommendations on international action for consideration by the UNEP Governing Council and the World Health Assembly not later than 1997.

Subsequently the IFCS provided recommendations to UNEP that served as a basis for the mandate to begin negotiations of a global POPs Convention. The IFCS recommended that available information was sufficient to demonstrate the need for international action on 12 POPs and that international action, including a global legally binding instrument, is required to reduce the risks to human health and the environment arising from the release of the 12 POPs.

In February 1997, the UNEP Governing Council in its decision 19/13C invited UNEP to prepare for and convene an International Negotiating Committee (INC), with a mandate to prepare an international legally binding instrument for implementing international action initially beginning with the 12 POPs. The Council further requested that the INC establish an expert group to develop criteria and a procedure for identifying additional POPs as candidates for future international action. The decision also included a number of immediate actions to address POPs.

The first meeting of the INC to develop an international legally binding instrument for implementing international action on certain POPs was held in June 1998 in Montreal, Canada, at which the Criteria Expert Group (CEG) requested above was established. Subsequent meetings of the INC were held in Nairobi, Kenya, in January 1999, in Geneva, Switzerland, in September 1999, in Bonn, Germany, in March 2000, and in Johannesburg, South Africa, in December 2000 where the negotiations were successfully completed. The CEG completed its mandate in two meetings: the first in Bangkok, Thailand, in October 1998 and the second, in Vienna, Austria, in June 1999. A meeting of 18 countries designated by the INC to deliberate on financial resources and mechanism held in Vevey, Switzerland, in June 2000 helped lay the groundwork for consensus on these issues at the final negotiations session.

The Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted and opened for signature at a Conference of Plenipotentiaries held from 22nd to 23rd May 2001 in Stockholm, Sweden. Ninety-two (92) States and the European Community signed it at a ceremony on 23rd May 2001. The Convention entered into force on 17th May 2004, 90 days after the submission of the fiftieth instrument of ratification.

Ghana signed and adopted the Convention on 23rd May 2001 in Stockholm, Sweden, and ratified it on 30th May 2003.

1.1.2 Objective of the Convention

The objective of the Stockholm Convention is to protect human health and the environment from persistent organic pollutants (Article 1). This is consistent with the precautionary approach set forth in Principle 15 of the Rio Declaration on Environment and Development.

1.1.3 Convention Provisions

There are four main areas of the Convention, namely:

- General Obligations
- Control Provisions: Intentionally Produced POPs, Unintentionally Produced POPs, Stockpiles and Wastes;
- Procedures for adding new POPs
- Financial and Technical assistance

1.1.3.1 General Obligations of Parties under the Convention

Each Party is obliged to:

- Develop, within two years after entry into force, plans for implementing the obligations of the treaty (Article 7);
- Designate a National Focal Point for exchange of information on production, use and release of POPs and on their alternatives (Article 9);

- Promote and facilitate public awareness and participation, education, research, development and monitoring on all aspects of POPs and their alternatives (Articles 10, 11);
- Report (Article 15) to the Conference of Parties (COP) on:
 - Measures taken to implement the provisions of the Convention and effectiveness of measures taken
 - Quantities of POPs in Annex A, B and C that are traded or released, and list of States involved

1.1.3.2 Control Provisions

Article 3 of the Convention urges states to take measures to reduce or eliminate releases from the intentional production and use of POPs. It requires states, among others, to prohibit and/or take legal and administrative measures to eliminate the production, use, importation and exportation of chemicals listed in Annex A (aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls or PCBs). States are also required to restrict production and use (for malaria vector control only) of chemicals listed in Annex B (Dichlorodiphenyltrichloroethane or DDT). There are special provisions for PCBs and DDT.

Article 5 requires Parties to put measures in place to reduce or eliminate releases from unintentional production of some of the banned chemicals. This article recommends the use of Best Available Techniques (BAT) and Best Environmental Practices (BEP).

There are provisions for measures to reduce or eliminate releases from stockpiles and wastes (Article 6). The goal is the environmentally sound management (ESM) of stockpiles, wastes, products and articles upon becoming wastes that consist of, contain or are contaminated with POPs. This is to be done in close collaboration with the appropriate bodies of the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal.

1.1.3.3 Procedures for Adding New POPs

Annex D of the Stockholm Convention specifies information requirements and screening criteria for listing a chemical in Annexes A, B and/or C of the Convention. These include information on:

- Chemical identity
- Persistence
- Bio-accumulation
- Potential for long-range environmental transport; and
- Adverse effects.

A statement of the reasons for concern including, a comparison of toxicity or ecotoxicity data with detected or predicted levels of a chemical resulting or anticipated from its long range environmental transport, and a short statement indicating the need for global control will be provided by a proposing Party. Additional information to support the review of the proposal referred to in paragraph 6 of Article 8 of the Convention will also be provided by the proposing Party. The secretariat of the Convention shall verify such information submitted by a Party and forward the proposals to a Persistent Organic Pollutants Review Committee (POPROC).

1.1.3.4 Financial and Technical Assistance

The Convention specifies that developing countries and countries with economies in transition will need technical and financial assistance. Regional and Sub-regional Centres will be established for capacity building and transfer of technology to assist countries in need. Developed countries have undertaken to provide technical assistance, new and additional financial resources to meet agreed full incremental implementation costs (Article 13).

The Global Environment Facility (GEF) has been designated as the principal entity entrusted with the operations of the financial mechanism on an interim basis (Article 14), and is required to support the execution of capacity building and related activities (e.g. the preparation of NIPs).

1.2 The “Dirty Dozen”: Definitions and Properties

The Stockholm Convention addresses the challenges posed by an initial target list of twelve (12) POPs (the so called “dirty dozen”), namely: aldrin, chlordane, Dichlorodiphenyltrichloroethane (DDT), dieldrin, endrin, heptachlor, mirex, toxaphene, polychlorinated biphenyls (PCBs), Polychlorinated dibenzo-*p*-dioxins (PCDDs) and Polychlorinated dibenzofurans (PCDFs). The list is separated into three groups, pesticides, industrial compounds, and by-products. Hexachlorobenzene belongs to all three groups. It is a pesticide (fungicide), a by-product of industry as well as an unintended by-product of combustion process. They are further classified into 3 broad categories as follows: Annex A chemicals (those for elimination), Annex B chemicals (those for restriction) and Annex C chemicals (unintentionally produced).

1.2.1 Pesticides

1.2.1.1 Aldrin

Chemical Name: 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo,exo-5,8-dimethanonaphthalene (C₁₂H₈Cl₆).

CAS Number: 309-00-2

Properties: Solubility in water: 27µg/L at 25°C; vapour pressure: 2.3 x 10⁻⁵ mm Hg at 20°C; log K_{ow}: 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 80mg/kg-body weight. The acute oral LD₅₀ in laboratory animals is in the range of 33mg/kg body weight for guinea pigs to 320mg/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 LC₅₀ values range from 1-200µg/L for insects, and from 2.2-53µg/L for fish. The maximum residue limits in food recommended by FAO/WHO varies from 0.006mg/kg milk fat to 0.2mg/kg meat fat. Water quality criteria between 0.1 to 180 µg/L have been published.

1.2.1.2 Chlordane

Chemical Name: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene (C₁₀H₆Cl₈).

CAS Number: 57-74-9

Properties: Solubility in water: 56µg/L at 25°C; vapour pressure: 0.98 x 10⁻⁵mm Hg at 25 °C; log K_{ow}: 4.58-5.57.

Discovery/Uses: Chlordane appeared in 1945 and was used primarily as an insecticide for control of cockroaches, ants, termites, and other household pests. Technical grade 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: LC₅₀ 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 LD₅₀ in rat of 200-590mg/kg body weight (19.1 mg/kg body weight for oxychlordane). 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 of 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.

1.2.1.3 Dichlorodiphenyltrichloroethane (DDT)

Chemical Name: 1,1,1-Trichloro-2,2-bis-(4-chlorophenyl)-ethane (C₁₄H₉Cl₅).

CAS Number: 50-29-3.

Properties: Solubility in water: 1.2-5.5 µg/L at 25°C; vapour pressure: 0.2 x 10⁻⁶ mm Hg at 20°C; logK_{ow}: 6.19 for *p, p'*-DDT, 5.5 *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. 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 metabolized mainly to DDD and DDE.

Toxicity: the lowest dietary concentration of DDT reported to cause eggshell thinning was 0.6 mg/kg for the black duck. LC₅₀ of 1.5mg/L for large mouth bass and 56mg/L for guppy have been reported. The acute toxicity of DDT for mammals is moderate with an LD₅₀ in rat of 113-118mg/kg-body weight. DDT has been shown to have an estrogen-like activity and possible carcinogenic activity in humans. The maximum residue levels in food recommended by WHO/FAO range from 0.02mg/kg milk fat to 5mg/kg meat fat. Maximum permissible DDT residue levels in drinking water (WHO) is 1.0µg/L

1.2.1.4 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 (C₁₂H₈Cl₆O).

CAS Number: 60-57-1

Properties: Solubility in water: 140 µg/L at 20°C; vapour pressure: 1.78 x 10⁻⁷ mm Hg at 20°C, log K_{ow}: 3.69-6.2.

Discovery/Uses: It appeared in 1948 after World War II and used mainly for the control of 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 in 4-40 hrs.

Toxicity: The acute toxicity for fish is high (LC₅₀ between 1.1 and 41 mg/L) and moderate for mammals (LD₅₀ in mouse and rats ranging from 40 to 70 mg/kg body weight). However, a daily administration of 0.6 mg/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 caused 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 between 0.1 to 18 µg/L have been published.

1.2.1.5 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 (C₁₂H₈Cl₆O).

CAS Number: 72-20-8

Properties: Solubility in water: 220-260 µg/L at 25°C; vapour pressure: 2.7×10^{-7} mm Hg at 25°C; log K_{ow}: 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 LC₅₀ values are mostly less than 1µg/L. The acute toxicity is high in laboratory animals, with LD₅₀ values of 3-43 mg/kg, and a dermal LD₅₀ of 5-20 mg/kg in rats. Long-term toxicity in the rat has been studied over two years and a NOEL of 0.05mg/kg-bw/day was found.

1.2.1.6 Heptachlor

Chemical Name: 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene (C₁₀H₅Cl₇).

CAS Number: 76-44-8

Properties: Solubility in water: 180 µg/L at 25°C; vapour pressure: 0.3×10^{-5} mm Hg at 20°C; log K_{ow}: 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 than heptachlor. Heptachlor epoxide 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 (LD₅₀ values between 40 and 119 mg/kg have been published). The toxicity to aquatic organisms is higher and LC₅₀ 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.

1.2.1.7 Hexachlorobenzene (HCB)

Chemical Name: Hexachlorobenzene (C₆Cl₆)

CAS Number: 118-74-1

Properties: Solubility in water: 50 µg/L at 20°C; vapour pressure: 1.09×10^{-5} mm Hg at 20°C; log K_{ow}: 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: Many of the available acute and chronic toxicity studies failed to demonstrate effects at or below the solubility limit, but based on validated long-term studies for fish, crustaceans and algae, a 90-day study on the fresh water fish *O. Mykiss* revealed the lowest NOEC of 3.7µg/L. The acute toxicity of HCB is low with LD₅₀ values of 3.5mg/kg for rats. Mild effects of the [rat] liver have been observed at a daily dose of 0.25mg/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.

1.2.1.8 Mirex

Chemical Name: 1,1a,2,2,3,3a,4,5,5a,5b,6-Dodecachloroocta-hydro-1,3,4-methano-1H-cyclobuta [cd]pentalene (C₁₀C₁₂).

CAS Number: 2385-85-5

Properties: Solubility in water: 0.07µg/L at 25°C; vapour pressure: 3x10⁻⁷ mm Hg at 25°C; log K_{ow}: 5.28.

Discovery/Uses: The use in pesticide formulations started in the mid 1950s largely focused on the control of ants. 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, Soya 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 2600 and 51400 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 = 52Pa/m³/mol).

Toxicity: The acute toxicity of Mirex for mammals is moderate with an LD₅₀ in rat of 235mg/kg and dermal toxicity in rabbits of 80mg/kg. Mirex is also toxic to fish and can affect their behaviour (LC₅₀ 96hr) from 0.2 to 30mg/L for rainbow trout and bluegill, respectively). Delayed mortality of crustaceans occurred at 1µg/L exposure levels. There is evidence of its potential for endocrine disruption and possible carcinogenic risk to humans

1.2.1.9 Toxaphene

Chemical Name: Polychlorinated bornanes and camphenes (C₁₀H₁₀C₁₈).

CAS Number: 8001-35-2

Properties: Solubility in water: 550µg/L at 20°C; vapour pressure: 3.3 x 10⁻⁵ mm Hg at 25°C; log K_{ow}: 3.23-5.50

Discovery/Uses: Toxaphene has been in use since 1949 as a non-systemic 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 76,000 in brook trout).

Toxicity: Toxaphene is highly toxic in fish, with 96-hour LC₅₀ values in the range of 1.8µg/L in rainbow trout to 22 µg/L in bluegill. Long-term exposure to 0.5µg/L reduced egg viability to zero. The acute oral toxicity is in the range of 49mg/kg-body weight in dogs to 365mg/kg in guinea pigs. In long-term studies NOEL in rats was 0.35mg/kg-bw/day, LD₅₀ ranging from 60 to 293mg/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 1.1mg/kg/day for oral exposure.

1.2.2 Industrial Compounds

1.2.2.1 Polychlorinated Biphenyls (PCBs)

Chemical Name: Polychlorinated biphenyls (C₁₂H_(10-n)Cl_n, 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 x 10⁻⁶ mm Hg at 20°C; log K_{ow}: 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 PCB 153 was more than ten years.

Toxicity: LC₅₀ for the larval stages of rainbow trout is 0.32 µg/L with a NOEL of 0.01 µg/L. The acute toxicity of PCBs in mammals is generally low and LD₅₀ values in rat of 1 g/kg bw. IARC has concluded that PCBs are carcinogenic to laboratory animals and probably also for humans. They are also classified, as substances for which there are evidence of endocrine disruption in an intact organism.

1.2.3 Unintended By-Products

1.2.3.1 Polychlorinated dibenzo-p-dioxins (PCDDs) and Polychlorinated dibenzofurans (PCDFs) (Dioxins and Furans).

Chemical Name: PCDDs (C₁₂H_(8-n)Cl_nO₂) and PCDFs (C₁₂H_(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 – 0.002 ng/L at 25°C; vapour pressure: 2-0.007x10⁻⁶ mm Hg at 20°C; log K_{ow}: 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: PCDDs/Fs are characterized by their lipophilicity, semi-volatility and resistance to degradation (half life of TCDD in soil of 10-12years) and to long-range transport. They are also known for their ability to bio-concentrate 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 aryl hydrogen receptor (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 fetus and neonatal infants.

Effects on the immune systems in the mouse have been found at doses of 10ng/kg bw/day, while reproductive effects were seen in rhesus monkeys at 1-2ng/kg/bw/day. Biochemical effects have been seen in rate down to 0.1ng/kg bw/day. In a re-evaluation of the TDI for dioxins, furans (and planer PCB), the WHO decided to recommend a range of 1-4TEQ pg/kg, bw, although more recently the acceptable intake value has been set monthly at 1-70TEQ pg/kg bw.

1.3 Preparation of NIP: Mechanism and Stakeholder Consultation Process.

An important obligation of the developing country Parties under the Stockholm Convention is the preparation of a National Implementation Plan (NIP) to protect human health and environment from POPs under Article 7 (**Box 1**). Article 7 requires Parties to prepare National Implementation Plans (NIPs). A National Implementation Plan is a formal planning document, which defines a country's commitments, current situation and actions, which it plans to undertake in the fields of POPs management.

Box 1: Article 7 of the Stockholm Convention: Implementation Plans

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

1.3.1 Purpose and Structure of NIP

An executive summary is provided to give an overview of the major points in the NIP document. This covers the country commitment to implement the NIP, the objectives of the Convention, national priorities and key issues, targets for implementation and resource requirements. The chapter on introduction outlines the purpose and structure of NIP including a summary of the Stockholm

Convention, its aims and obligations. A stakeholder consultation process was paramount in the development of the NIP. The introduction also gives a summary of the POPs issue, providing context and background of the 12 listed chemicals, their uses and problems caused by them. The chapter on country baseline provides basic background information relevant to the NIP. It describes the current situation and state of knowledge in the country about POPs and status of institutional and other capacity to address the problem. The section under strategy and action plan elements, of the NIP has two elements – a formal policy statement and the implementation strategy for the NIP. The implementation strategy sets out specific activities, action plans and strategies to achieve Convention obligations and other objectives set in the country. There are a number of annexes to the document, providing detailed background data and information, specific action plans and other relevant information to meet the objectives of the NIP.

1.3.2 General Principles

This document has been prepared taking into account of the following issues, which are considered important to the successful development of the NIP (**Box 2**):

Box 2: General Guiding Principles for NIP Development

- NIPs should be tailored to meet the needs of the Party, suitable for use by the Party to meet the obligations of the Stockholm Convention and will be submitted to the Conference of Parties
- The development of a NIP should build on existing work and assessments where they are available and should not “reinvent the wheel”.
- NIPs should not be developed in isolation but should take due account of the aims of sustainable development in the sense of socially, economically and environmentally appropriate policies and actions to maximise the overall benefits. They should be linked to related initiatives where possible to ensure maximum efficiency and reduce duplication of effort.
- The Convention places obligations on the Parties for 12 chemicals. However, a procedure exists for adding further chemicals to the Convention, therefore it is important that the procedure for developing a NIP is able to respond to the listing of new chemicals
- This guide should be used in conjunction with the Convention text and Annexes and does not substitute the Convention text for a legal interpretation of the text or a point-by-point analysis of the measures required in a particular country.

1.3.3 Summary of NIP Preparatory Phases

In preparing the NIP cognizance was taken of article 7 (2) and (3) above. It was also executed in accordance with the UNEP/World Bank guidance document, which was endorsed by the POPs INC-7 (UNEP/POPs/INC.7/10) in Geneva, July 2003 and revised in December 2003. The five phases of development are as follows:

- Establishment of Coordinating Mechanism and Process Organisation;
- Establishment of POPs Inventories and Assessment of National Infrastructure and Capacity;
- Priority Assessment and Objective Setting;
- Formulation of National Implementation Plan;
- Endorsement and Submission of NIP.

Each phase of the process had a detailed series of objectives, tasks and actions, which were undertaken, by identified individuals and groups (e.g. Task Teams). The main activities followed by Ghana were to:

- Undertake preliminary inventories of sources and emissions of POPs listed in Annexes A and B to the Convention;
- Develop an Action Plan for the reduction of releases of unintentionally by-products Article 5 outlines some of the elements as inventory of current and projected releases, an assessment of enforcement capacity and adequacy of laws and policies to meet the obligations of by-products reduction of the Convention, and strategies to meet these obligations;
- Build capacity to report every five years on progress in phasing out PCBs as described in Annex I part II of the Convention;
- Prepare a preliminary assessment of stockpiles of POPs and waste products contaminated with POPs, and identify management options, including opportunities for disposal;
- Build capacity to report to the Conference of Parties (COP) on total production, import and export, as per Article 15 of the Convention;
- Build capacity to assess the need of continuation of specific exemptions and preparation of their reporting/extension;
- Build capacity to identify sites contaminated with POPs; and
- Support communication, information exchange, and raising awareness through multi-stakeholder participatory processes, as described in Article 9 and 10.

A schematic representation of the NIP process is provided in Annex I.

1.3.4 Stakeholder Participation

The POPs issue impacts on many sectors of society and economy including policy-making, law-making, environmental protection, agriculture, public health, industry, private sector, the public and various interest groups. Relevant national stakeholder institutions and groups were identified, sensitized and assigned with responsibilities from the on set of the NIP development Process. An initial workshop intended to provide an excellent opportunity for raising awareness at the national level as well as bringing together all relevant stakeholders in sound chemicals management for an open discussion and effective communication was organized. To ensure continuity a multi-stakeholder National Coordinating Team (NCT) for sound management of chemicals was set up in 1996 to oversee the preparation of UNITAR/IOMC sponsored National Profile on Chemicals Management pilot project (1996/97). The NCT also coordinated the UNITAR/IOMC National Action Programme for Integrated Chemicals Management project in Ghana (1997-1999). These stakeholders served as core members of the Steering Committee of the POPs enabling activities project. The following national stakeholder institutions actively participated in the NIP development in Ghana.

- Government Ministries and Agencies:
 - i) Ministry of Environment and Science (MES)
 - ii) Environmental Protection Agency.
 - iii) Ministry of Food Agriculture (MOFA) (Plant Protection and Regulatory Services Directorate, Veterinary Services Department),
 - iv) Customs, Excise and Preventive Service (CEPS)
 - v) Ministry of Finance and Economic Planning
 - vi) Ministry of Health (Ghana Health Service, Food and Drugs Board)
 - vii) Ministry of Trade, Industry and Presidential Special Initiative
 - viii) Ghana Standards Board
 - ix) Ministry of Employment and Manpower Development (Factories Inspectorate Department)
 - x) Ministry of Roads and Transport
 - xi) Ministry of Education, Youth and Sports
 - xii) Ministry of Justice (Attorney Generals Department)

- xiii) Ministry of Local Government and Rural Development
- xiv) Ministry of Women and Children’s Affairs
- xv) Ministry of Works and Housing (Ghana Water Company Limited)
- xvi) Ministry of Interior (Ghana Police Service)
- xvii) Electricity Company of Ghana
- xviii) Volta River Authority

- Non-Governmental Organizations
 - i) Environmental Interest Groups (Green Earth, Friends of the Earth-Ghana, Green Club of Ghana)
 - ii) Pesticide Industry Associations
 - iii) Industrial Chemicals Associations
 - iv) Trades Union Congress (Petroleum and chemicals workers union)
 - v) Public Interest Groups (Ghana Chemical Society)
 - vi) Ghana National Association of Farmers and Fishermen
 - vii) Association of Ghana Industries
 - viii) Women and Children Activists.

- Academic and Research Institutions
 - i) Council for Scientific and Industrial Research
 - ii) Ghana Atomic Energy Commission
 - iii) University of Ghana (Chemistry Department, Biochemistry Department)
 - iv) Kwame Nkrumah University of Science and Technology (Chemistry Department, Electrical Engineering)
 - v) University of Cape Coast (Chemistry Department)
 - vi) Water Resources Commission
 - vii) Cocoa Research Institute of Ghana
 - viii) Water Research Institute

- Media (Electronic and Print)
 - i) Ghana Broadcasting Corporation
 - ii) Other public and private media

- Regional Economic Integration
 - i) ECOWAS
 - ii) NEPAD

- International organizations
 - i) United Nations Industrial Development Organization (UNIDO)
 - ii) United Nations Development Programme (UNDP)
 - iii) United National Environment Programme (UNEP)
 - iv) World Bank
 - v) Food and Agricultural Organization of the United Nations (FAO)
 - vi) World Health Organization (WHO)

CHAPTER 2: COUNTRY BASELINE INFORMATION

2.0 Introduction

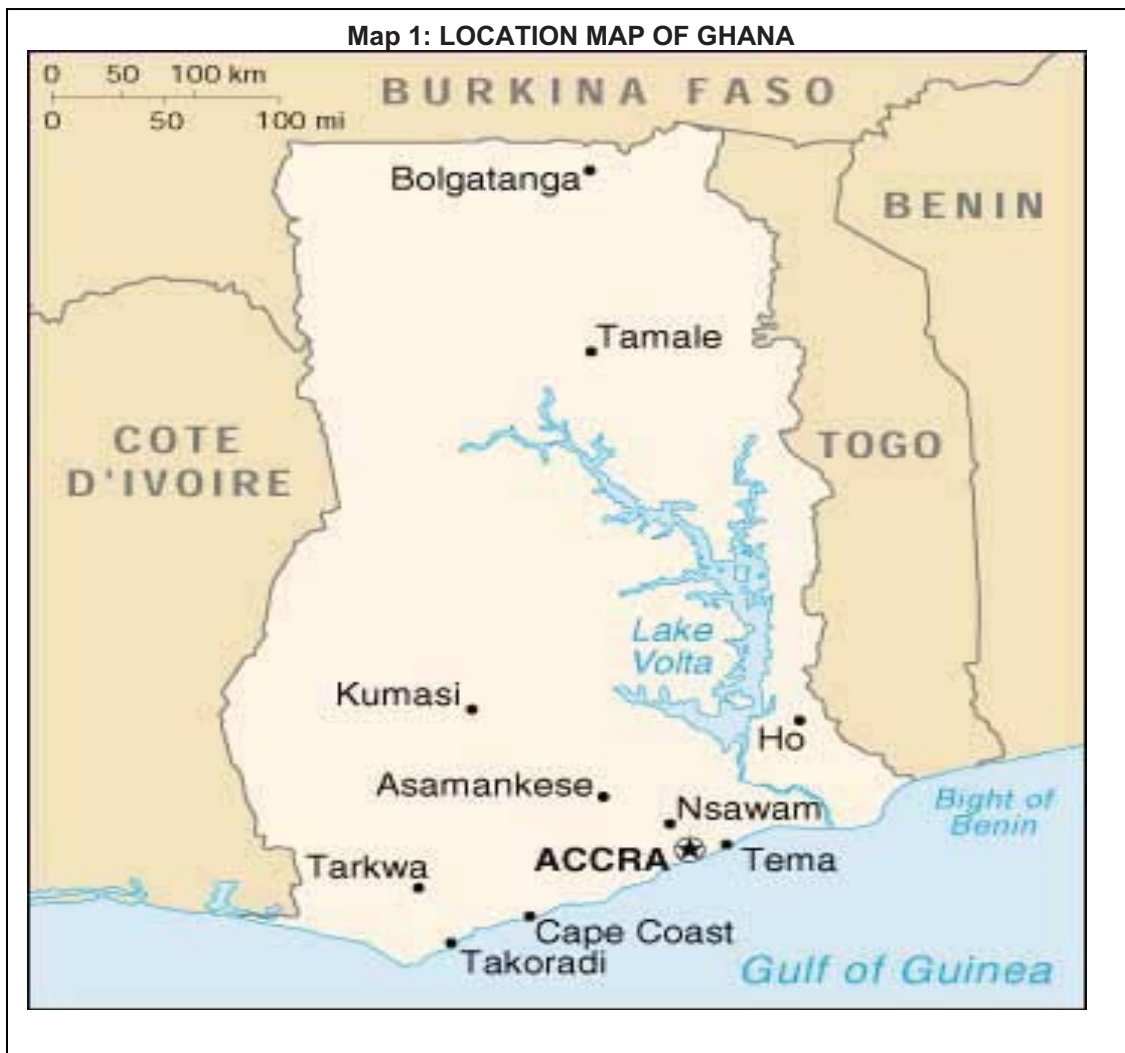
This chapter provides basic background information relevant to the NIP. It describes the current situation and state of knowledge in the country about POPs and the status of institutional and other capacities to address the problem.

2.1 Country Profile

2.1.1 Geography and Population

2.1.1.1 Location

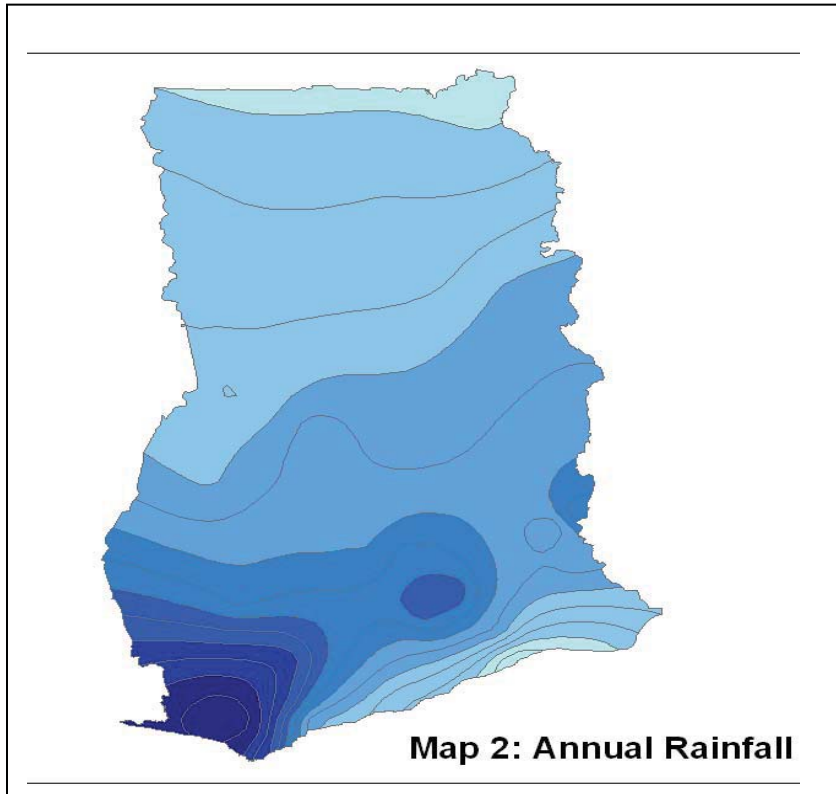
Ghana lies between latitudes 4° 44' and 11° 15' N and longitudes 3° 15' W and 1° 12' E with a land area of 238,539 km². It is bounded to the east by the Republic of Togo and to the west by La Cote d'Ivoire. To the north is Burkina Faso and to the south is the Gulf of Guinea (see map 1). Source of maps



2.1.1.2 Bio-physical Environment

(a) Climate

The Sudan Savannah zone is characterized by a uni-modal rainfall regime lasting 5-6 months and a long dry period of 6 – 7 months in a year. Average annual rainfall, temperature, relative humidity, wind speed, sunshine hours and solar radiation are 885 mm, 28.6°C, 54%, 81 km/day, 7.9 hours and 20.4 MJ/m²/day respectively. Potential evaporation is 1652 mm per annum and the annual aridity index is 0.60 (see Map 2).



The Guinea Savannah experiences a similar rainfall pattern as in the Sudan Savannah zone. Average annual rainfall, temperature, relative humidity, wind speed, sunshine hours and solar radiation are 1033 mm, 28.1°C, 61%, 138 km/day, 7.3 hours and 19.6 MJ/m²/day respectively. Potential evaporation is 1720 mm per annum and the annual aridity index is 0.60.

The Coastal Savannah zone has bimodal rainfall with an annual average of about 810 mm. Average annual aridity index, temperature, relative humidity, wind speed, sunshine hours and solar radiation are 0.54, 27.1°C, 81%, 251 km/day, 6.5 hours and 18.6 MJ/m²/day respectively. Annual potential evaporation is about 1504 mm.

The Forest-Savannah Transitional zone is characterized by bimodal rainfall regime with an annual total of 1250 mm and a potential evapotranspiration of about 1430 mm. The annual aridity index is 0.87. Average annual temperature, relative humidity, wind speed, sunshine hours and solar radiation are 26°C,

75%, 133 km/day, 6.2 hours and 18.1 MJ/m²/day. In all the ecological zones, rainfall is generally accompanied by high intensities and energy loads. The rains are therefore highly erosive.

The High Rainforest has rainfall in excess of 1500 mm a year and mean monthly temperatures are above 20°C.

(b) Vegetation

Ghana is divided into six vegetation zones and corresponds to climate types namely Sudan, Guinea and Coastal Savannah zones, the Forest-Savannah Transitional zone, the Semi-deciduous Forest and the High Rainforest Zones.

The Sudan Savannah covers an estimated area of 1,900 km² and consists of short drought and fire resistant deciduous trees interspersed with open savannah grassland. Grass cover is very sparse and in most areas the land is bare and severely eroded.

The Guinea Savannah covers almost the northern two-thirds of the country with an area of 147,900 km². The vegetation consists typically of a ground cover of grasses of varying heights interspersed with fire resistant, deciduous, broad-leaved trees at the forest margins. These grade into more open grassland with widely spaced shorter trees towards the north.

The Coastal Savannah covers an estimated area of 4500 km². It consists of mainly grassland interspersed with dense thickets often less than 5m high with a few trees. Short and medium grasses are the dominant species.

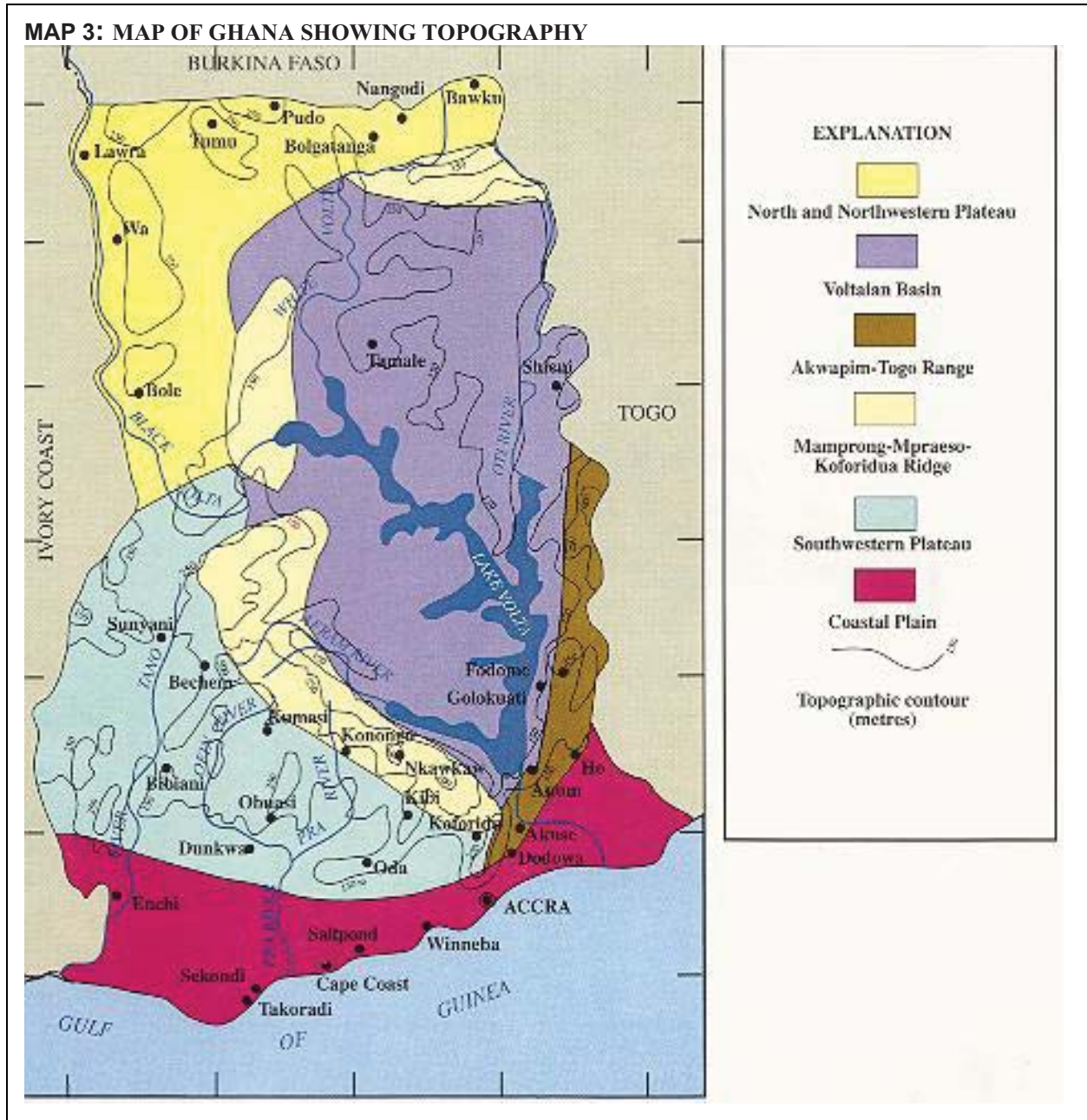
The Forest-Savannah Transitional Zone (Derived Savannah) covers about 8,300 km². Most of the tree species, similar to those in the forest zone, occur in association with tall to medium tall grasses.

The Semi-Deciduous Forest zone is about 66,300 km² in extent and forms about 90% of the total forest zone. The characteristic associations are *Celtic-Triplochiton* and *Antiaris-Chlorophora*. The indicator trees for the former consist of *Celtic milbraedii* and *Triplochiton scleroxylon* whilst the latter is characterized by *Antiaris africana* and *Chlorophora excelsa*. It is within this zone that most food crops, timber extraction and cocoa cultivation takes place. Most of the timber for both local needs and export comes from the zone. As a result of these activities the vegetation outside the forest reserves consists mainly of forest regrowth, thicket, secondary forest and swamp thicket.

The High Rainforest zone covers an area of about 7,500km² and is located in the southwestern corner of the country. The vegetation is generally evergreen although some species common to the semi-deciduous forest may be found. Such species tend to shed their leaves during the dry season. The zone is characterized by the *Cynometra-Lophira-Tarrietia* association with *Cynometra ananta*, *Lophira alata* and *Tarrietia utilis* as indicator trees (Lane, 1962). The topography is undulating to rolling with numerous fresh water swamps potentially suitable for rice cultivation occupying low-lying valley bottoms. The swamp vegetation consists of raphia palms with shrubs such as *Alchornea cordifolia*, *Caropa procera* and *Macaranga* spp. entangled by various climbers.

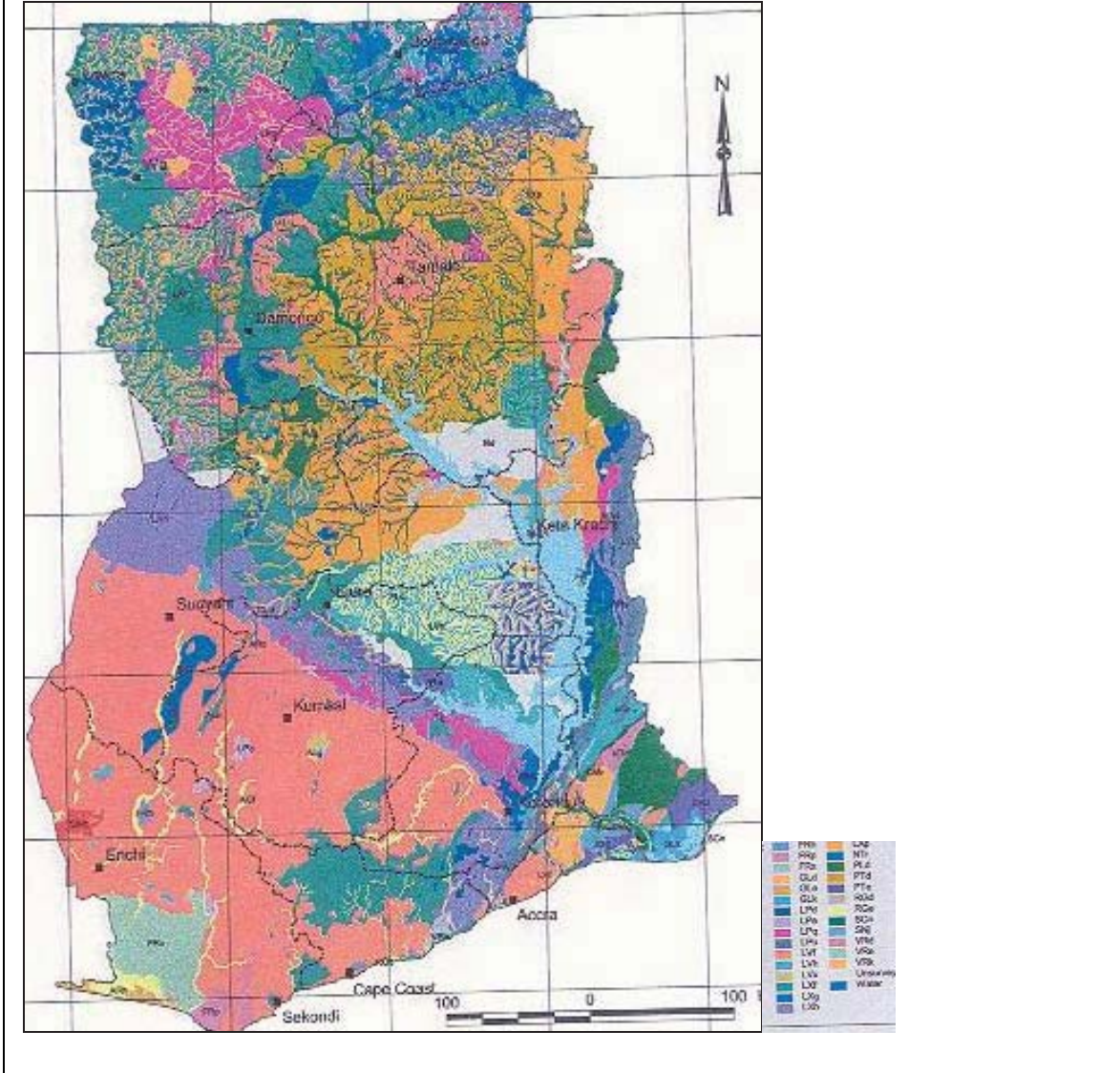
(c) Topography

The topography is gently undulating and low in relief with slopes of 3 to 4 percent dominating. Most of the area lies between 153 and 244 meters above sea level (see map 3). Under the climax vegetation the slopes are stable. However when the vegetation is cleared conditions become unstable and high rates of erosion are inevitable.



(d) Soils

The major soils are Lixisols, Acrisols, Nitisols, Luvisols, Lithosols, Plinthosols, Gleysols and Cambisols. Alluvial soils (Fluvisols) and eroded shallow soils (Leptosols) are found in all the ecological zones (see Map 4). Most of the soils are developed on thoroughly weathered parent materials. Their organic matter content, buffering capacity and cation exchange capacity are low. The soils are consequently of low inherent fertility with nitrogen and phosphorus as the most deficient nutrients. Many of the soils have predominantly light textured surface horizons, heavier textured soils being confined to the valley bottoms and the Accra Plains. In the savanna zones there are extensive areas of iron pan and shallow concretionary and rocky soils, which have low water holding capacities and limited suitability for agriculture.

Map 4: MAP OF GHANA SHOWING SOIL TYPES**(e) Water Resources**

The major sources of water are natural rainfall, rivers, streams, lakes, groundwater and artificially impounded water such as dams, dugouts and reservoirs. Naturally, rainfall is the single source of water that feeds all the other sources. Whenever rainfall is insufficient, recharge of water from the other sources is low.

(f) Human Population

The country's population is 18.9 million (2000 Population and Housing Census) and represents an intercensal growth rate of 2.7 percent. This figure is lower than the rate for West Africa (2.9 %) but high in comparison to the rate for the world (1.5 %). The birth rate is estimated at 39 per thousand (1999) while the death rate is estimated at 10 per thousand (1999). The rate of infant mortality is approximately 66 per thousand-live birth while the overall life expectancy is 59 years (1999). The current total fertility rate is 4.5 children per woman (2000).

The Ghanaian population is made up of many ethnic groups. According to the 2000 Population and Housing Census, the break down of the ethnic composition is as follows: Akans (49.1%), Mole-Dagbon (16.5%), Ewes (12.7%), Ga-Dangme (8.0%), and others (3.7%). There are three main religious groupings in Ghana: Christianity, Islam and the Traditional. Based on the 2000 census figures, Christianity is dominant with over two-thirds (68.8%) of the population followed by Islam (15.9%) and traditional religion (8.5%).

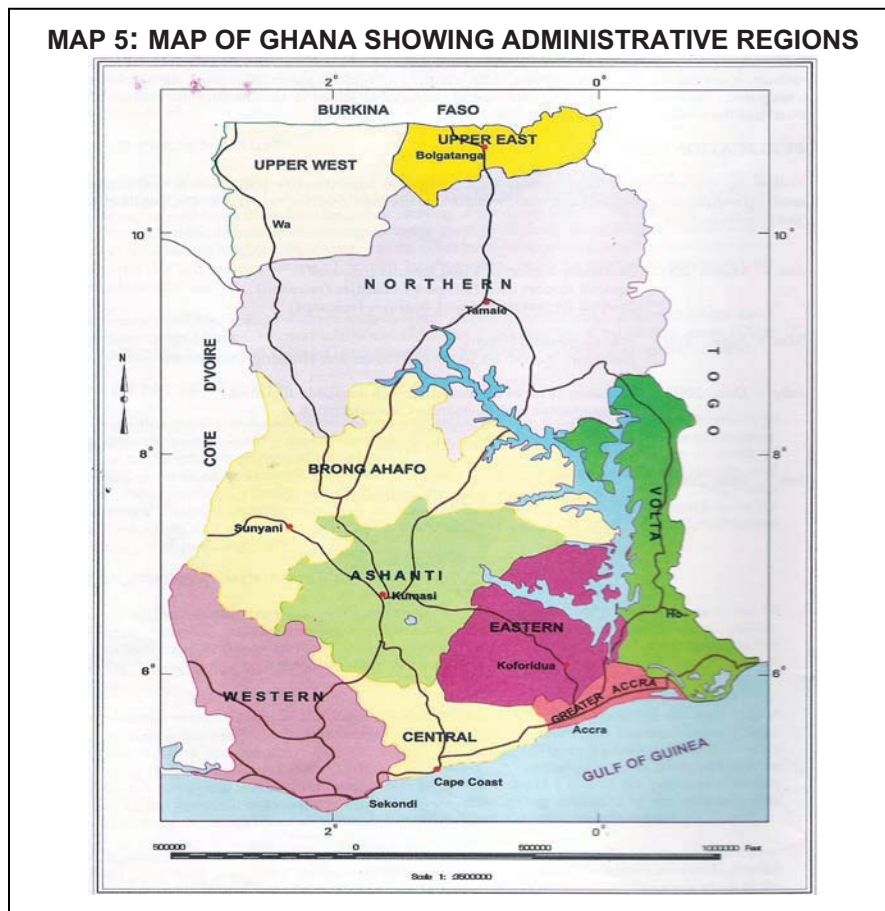
2.1.2 Political and Economic Profile

2.1.2.1 Political Profile

Ghana is governed under a republican multi-party constitutional democracy with executive powers vested in the President while legislative powers rests with unicameral legislature of 200 members serving a four-year term at the national level. In addition, the country operates a local government system comprising Regional Coordinating Councils, Metropolitan, Municipal and District Assemblies. The official language is English.

The country has ten administrative regions. These are Ashanti, Brong-Ahafo, Central, Eastern, Greater Accra, Northern, Volta, Upper East, Upper West and Western regions. The country is further divided into 138 districts, which form the basic units of political administration.

Ghana is a member of the following sub-regional and regional organisations: Economic Community of West African States (ECOWAS), African Union (AU) and African Ministerial Conference on Environment (AMCEN).



2.1.2.2 Economic Profile

Ghana is classified as a developing country with a per capita income of US\$ 390 (1996). Agriculture and livestock employs 55% of the economically active population. It is predominantly smallholder, traditional and rain-fed, with 85% of the country's 1.8 million farms being smaller than 2 hectares. Only about 12% of Ghana's land is classified as cropped land. Cocoa is the main cash crop and is grown on 40% of the cropped land. It accounts for about 75% of agricultural exports. Other commercially important tree crops are oil palm, coconut, rubber, kola and coffee.

2.1.3 Profiles of Economic Sectors

2.1.3.1 The Agricultural Sector

Ghana's economy is dominated by the agricultural sector in terms of its share of Gross Domestic Product (GDP), employment, foreign exchange earnings and provision of food security. The sector currently employs about 70% of the rural labour force, contributes 45% of the GDP, accounts for over 55% of the foreign exchange earnings and is responsible for meeting over 90% of the food needs of the country. The sector comprises five sub-sectors, namely: crops other than cocoa (63% of GDP), cocoa (14%), forestry (11%), livestock/poultry (9%) and fisheries (5%).

The overall growth rate of the agricultural sector, vis-à-vis the current annual population growth rate of 2.6%, is 2.8%. The small margins between these figures have serious implications for the attainment of food security, employment generation and improvement in rural incomes and national economy. While sustainable agricultural production depends primarily on productive soils, the land resources of Ghana, particularly the soil, are being degraded as a result of the interaction of both natural and anthropogenic factors. Meeting the future food needs of Ghana, while reducing poverty and protecting the environment would require halting and reversing soil degradation through restorative measures of soil and water conservation, nutrient and crop management.

2.1.3.1.1 Livestock Population

The savannah areas of Ghana carry most of the livestock population. The Upper West, Upper East and Northern Regions constitute the northern savannah zone. This zone holds 74.4%, 36.4% and 43.4% of the national cattle, sheep and goat stocks respectively. The livestock (cattle, sheep and goats) population density per km² in 1996 was 130, 33 and 16 for the Upper East, Upper West and Northern Regions respectively. The Upper East Region has the highest livestock population density.

2.1.3.1.2 Agro-Industry

Majority of products for agro-processing are highly perishable. Processing enhances the storage life of the perishables, thus serving as a means of securing food for the lean season as well as supporting household incomes. However, the achievement of these goals is constrained by the inadequate agro-processing facilities, particularly at the community level. The development of the requisite infrastructure for community-based agro-industry would therefore contribute significantly to the attainment of food security and enhancement of the incomes and livelihoods of rural households.

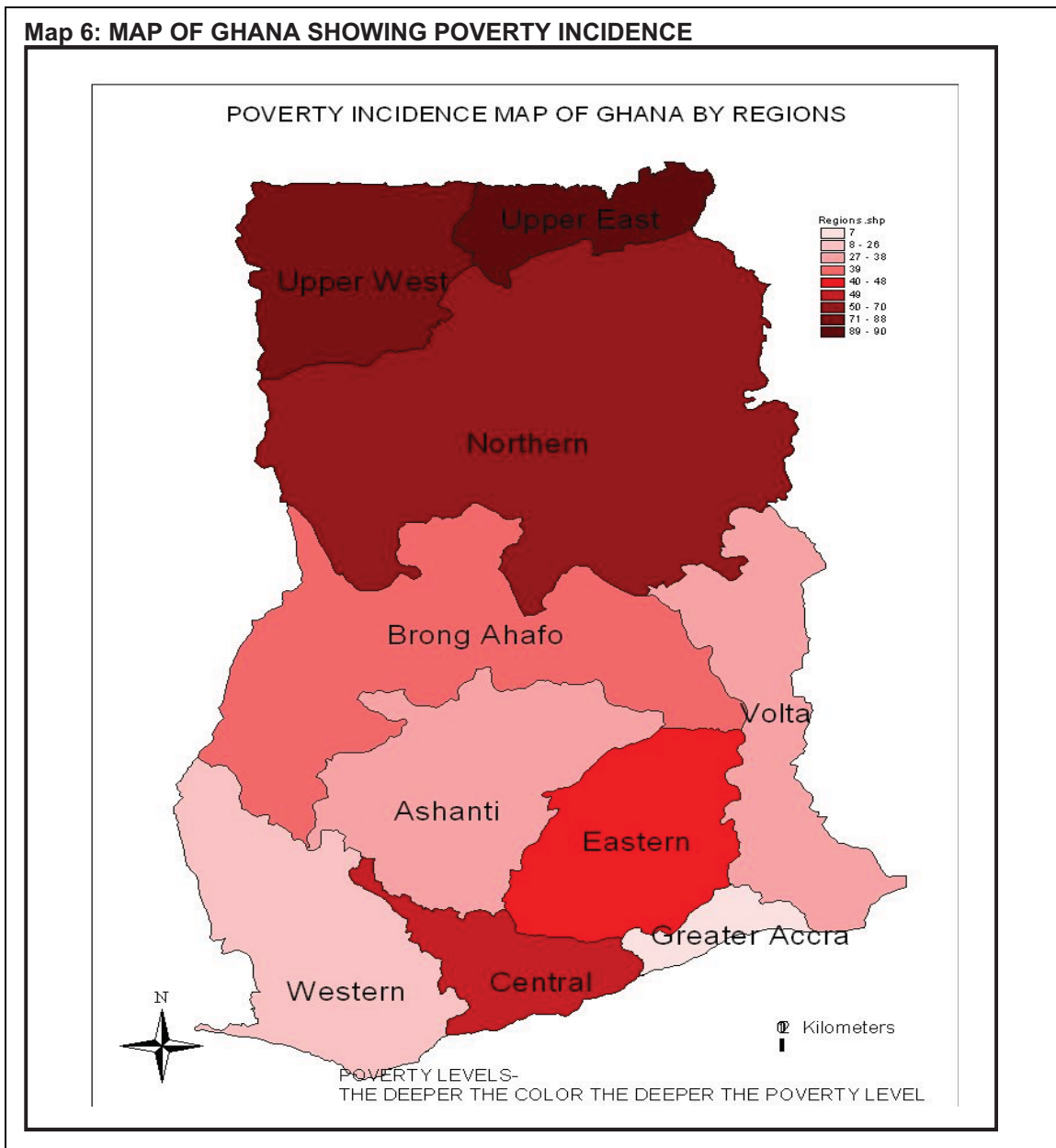
2.1.3.1.3 Marketing

Agricultural marketing in Ghana is private sector dominated. Most producers depend on a complex chain to take their outputs from the farm gate to the urban consumer. The market position of small holder farmers is very weak, in that they mostly sell in small amounts to itinerant traders, usually soon after

harvest and at low prices to meet their cash needs, and/or pay off cash loans. The problems in the development of traditional markets include inadequate marketing infrastructure (e.g. storage and processing facilities) which results in high post harvest losses, lack of market information which prevents the market from operating in a competitive manner, and lack of transport infrastructure. Solutions to these problems would contribute to improved marketing and distribution of agricultural produce and food security.

2.1.3.1.4 Alternative Income Generation Activities

The economy of Ghana is basically agro-based. Majority of the rural households depend on land resources for their livelihood. Provision of support for rural communities who engage in non-agricultural and off-farm enterprises could reduce the pressure on the fragile land resources with a consequent reduction in land degradation whilst enhancing the income of rural households.



2.1.3.1.5 Rural Infrastructure Development

Reducing the impacts of POPs and eventual elimination from the environment cannot be achieved without due regard to the general socio-economic environment of the people. For the survival of the populations and to ensure food security, there is the need to provide certain basic infrastructure for water and sanitation, health, education, markets, storage, agro-processing and accessibility (roads). Improvement in rural access roads leads to reduced transport costs, enhanced access to health and market facilities and consequent reduction in post-harvest losses especially for perishable agricultural produce.

Water and sanitation and health infrastructure result in improved health which in turn enables the communities to engage in productive activities, such as farming. Provision of education facilities will equip communities to be better informed and make informed choices. Post-harvest facilities (e.g. storage) afford the producer and the consumer time utility and to even-out supply as against demand. The link between good infrastructure and general economic development is very strong and critical as far as the sound management of chemicals is concerned.

2.1.3.1.6 Access to Inputs of Production

Withdrawal of government subsidy on agricultural inputs, e.g. seeds, fertilizers, agro-chemicals, etc is one of the contributing factors to low agricultural productivity. As inputs become more expensive, farmers tend to use less than recommended rates or unapproved cheaper inputs at the expense of increased yield and healthy lifestyles. Access to credit for farm activities is often constrained by the high-risk nature of crop production.

Rural cultural systems put a high premium on social activities than on rural agricultural and small-scale rural cottage industries. This has an adverse effect on food security.

Possible interventions among others, to overcome these problems include promotion of access to recommended inputs for production and of block farming schemes, development of supervised input-product marketing credit schemes and establishment of special revolving fund for production, promotion of inventory credit, formation of community co-operatives and credit unions and creation of financial incentives (e.g. review of tax policy to accommodate agricultural subsidies).

2.1.3.1.7 Agricultural Diversification

Agricultural diversification provides opportunity for farmers to accommodate risks in their enterprise, enhance their incomes and security. The current agricultural production base therefore needs to be expanded to cover non-traditional produce through introduction of small-scale irrigation schemes for dry season farming and vegetable production. Mixed farming needs to be promoted and intensified. Promoting the production of small ruminants and poultry will contribute to the protein needs of households and also enhance income generation for better livelihoods.

2.1.3.1.8 Food Security

Rain fed agriculture has not been able to sustain year round food production and availability as well as vegetative cover. It has not been successful in fully utilising and harnessing rainfall in agricultural production to generate surpluses for storage for the lean season. Availability of water is therefore central to an effective strategy for ensuring food production.

Provision of water through small irrigation schemes, dugouts, water harvesting, soil and water conservation, promotion of integrated dry land farming systems, development of drought tolerant crops and use of improved crop and livestock husbandry practices will, among other factors, contribute to increased food production and food security.

2.1.3.1.9 Socio-economic and Cultural Impacts of POPs

Providing adequate supply of food and improving the health of a rapidly increasing human population are two of the current greatest challenges. The annual rate of increase in food production in tropical developing nations, such as Ghana, is less than 1.0%, while in most of these countries; the population is growing at an annual rate of 2.0%. There is thus, a serious gap between food supply and demand.

Pests (including insects, diseases, weeds) compound this problem by destroying agricultural crops in the field and in storage. Pre- and post-harvest losses of agricultural crops are estimated at an average of 35% and are highest in the tropics, particularly Africa.

In the quest to achieve minimum crop losses and maximum control of vector-borne diseases, society incurs great cost in terms of pesticide abuse and misapplication, environmental pollution and the implications for the health of society both in the short and long term. Some of the ‘dirty dozen’ are employed in industrial and manufacturing processes, while others are also released as by-products or wastes from other processes.

2.1.3.2 The Industrial Chemical Sector

The chemical industry in Ghana has grown steadily since the advent of the structural adjustment programme in the 1980’s and 1990’s. This has resulted in the increasing amount of the importation of various types of chemicals both for industrial and agricultural purposes.

A variety of chemicals are imported for agriculture, cosmetics, food, plastics, laboratory, petroleum, and a host of other industries. As a result of the problems of waste management (both general and hazardous wastes), pollution of air, water and land are increasingly posing problems.

2.1.3.2.1 Poverty and the Chemical Industry

Poverty is pervasive in the country. Available figures indicate that in 1999, five out of the ten regions in Ghana have more than 40% of their population living in poverty with the Upper East, Upper West and Northern Regions being the worst affected (See Map 6). In terms of economic activity, poverty is by far highest among food crop subsistence farmers. It is recognized that poverty is a major contributory factor underlying socio-economic cause of mis-use and abuse of agricultural and other chemicals. It often limits the ability of the poor to adopt sustainable measures although they may be aware of the necessity for sound management. Any strategy aimed at eliminating POPs from the environment and its attendant effect on human health should therefore be directed at interventions for poverty reduction. Among suggested interventions, in line with the government’s poverty reduction strategy, is increasing per capita agricultural yields as a first step. The objective is to enhance food production and security and rural incomes and livelihoods by increasing crop and livestock production and yield through improved soil and water management practices, crop and livestock husbandry and access to production inputs and possibly including application of POPs.

2.1.4 Environmental Overview

Ghana has ratified some chemicals related multilateral environmental agreements (MEAs) (such as the Rotterdam Convention, Basel Convention and the Montreal Protocol) and participated in international discussion on the environment. A conscious effort to make the environment a policy issue however begun in earnest after the Stockholm Conference on the Human Environment of 1972. It led to the creation of the Environmental Protection Council in 1974, which later became the Environmental Protection Agency in 1994. As a Council, its powers were mainly advisory though a number of policies and initiatives were put in place to enable Ghana meet some of her obligations at the international level.

The mission of the EPA is to co-manage, protect and enhance the country's environment, in particular, as well as seek common solutions to global environmental problems. Its core functions involve the employment of a broad range of strategies and tools to influence and change environmental attitudes and behaviour change including:

- Educating and informing;
- Advising and assisting, where necessary;
- Directing, enforcing and monitoring; and
- Research.

Ghana's effort towards the sound management of chemicals has been growing steadily following the UN Conference on Environment and Development in Rio de Janeiro, Brazil, in 1992.

Despite these efforts, proper management of chemicals is still at a low level. Capacity for monitoring and research on the fate of POPs on human health and the environment is also low. This could be attributed to many factors, prominent among which are the existing legal framework, institutional and legal gaps/inadequacies, poverty, lack of funds for research and ignorance.

2.2 Institutional, Policy and Regulatory Framework

2.2.1 Environmental Policy, Sustainable Development Policy and General Legislative Framework

The environmental impacts of the Structural Adjustment Programme (SAP) and Economic Recovery Programme (ERP) in the early 1980s in Ghana led to the development of the Ghana Environmental Action Plan (EAP), a set of policy actions, related investments and institutional strengthening activities to make Ghana's development strategy more environmentally sustainable. The areas directly linked to the EAP are:

- Land management
- Water management
- Marine and coastal systems
- Industrial pollution
- Mining
- Hazardous chemicals management
- Human settlements.

This action plan from which incorporates the National Environmental Policy was published in 1991. The ultimate aim of Ghana's environmental policy is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. The policy, specifically, seeks to:

- Maintain the ecosystems and ecological processes essential for the functioning of the biosphere;
- Ensure sound management of natural resources and the environment; adequately protect humans, animals and plants, their biological communities and habitats against harmful impacts and destructive practices, and preserve biological diversity;
- Guide development in accordance with quality requirements to prevent, reduce, and as far as possible, eliminate pollution and nuisances;
- Integrate environmental considerations in sectoral structural and socio-economic planning at the national, regional, district and grass root levels;
- Seek common solutions to environmental problems in West Africa, Africa and the world at large.

There is a policy framework for the management of potentially bioaccumulative and toxic substances, which includes POPs in Ghana. The framework is however inadequate and incapable of dealing with the specific requirements of the Stockholm Convention on POPs. It may have some relevance but not

necessarily aimed at the management or elimination of POPs. There is therefore the need for a comprehensive legislation to deal with all chemicals.

There are a number of laws that have some relevance to the POPs listed in the Stockholm Convention. Many of these laws however, do not address the dangers posed to humans and the environment by the chemicals in question. Where they may be relevant, the institutions that deal with them do not have the resources to monitor or research into their disposal as required by the Stockholm Convention. The existing laws are listed under section 1.3 below.

The Pesticides Control and Management Act, 1996, (Act 528), is the only legislation that addresses the importation, manufacture, formulation, distribution, use and transportation of pesticides in Ghana. The non-pesticides POPs are however, not covered by the Act. Public awareness of the requirements of these laws is also low and compliance is also consequently low.

A framework exists for multi-sectoral collaboration in the control and management of chemicals in the country. The EPA is the coordinating institution and the key Ministries, Departments and Agencies (MDAs) that participate in meetings of committees aimed at sound chemicals management in the country include:

- Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture;
- Ghana Standards Board;
- Ghana Atomic Energy Commission;
- Customs, Excise and Preventive Service;
- Ministry of Health/Ghana Health Service;
- Food and Drugs Board;
- Universities and Research Institutions and
- Non-Governmental Organisations (NGOs).

2.2.2 Roles and Responsibilities of Ministries, Agencies and other Governmental Institutions Involved in POPs Life-cycles (from source to disposal, environmental fate and health monitoring)

In addition to the numerous uncoordinated pieces of legislation and regulations, there are also a number of institutions whose activities have bearing on POPs management, regulation and enforcement. Institutions and their functions are presented in Table 1 below.

Table 1: Roles and Responsibilities of Relevant Institutions Related to Chemicals Management

Agency/Organisation/Institution	Statutory Roles Relevant to POPs			
	Policy	Monitoring or Research	Regulatory and /or Enforcement	Service Provider
Ministry of Local Government, Rural Development and Environment				
Environmental Protection Agency				
Council for Scientific and Industrial Research				
Department of Town and Country Planning				
Ministry of lands, Forestry and Mines				
Mines Department				
Minerals Commission				
Ministry of Finance				
Customs, Excise and Preventive Service				

Table 1: Roles and Responsibilities of Relevant Institutions Related to Chemicals Management (Continued)

Agency/Organisation/Institution	Statutory Roles Relevant to POPs			
	Policy	Monitoring or Research	Regulatory and /or Enforcement	Service Provider
Ministry of Education, Science and Sports				
Ministry of Health/Ghana Health Service				
Food and Drugs Board				
Ministry of Food and Agriculture				
Veterinary Services Directorate of MoFA				
Plant Protection and Regulatory Services Directorate (MoFA)				
Ministry of Trade, Industry, Private Sector Development and President's Special Initiatives				
Ghana Standards Board				
Ghana Atomic Energy Commission				
Ministry of Energy				
Energy Commission				
Ghana National Petroleum Corporation				
Ministry of Roads and Transport				
Ministry of Ports, Harbours and Railways				
Ghana Ports and Harbours Authority				
Regional Maritime Academy				
Ministry of Works and Housing (Hydro Department)				
Water Resources Commission				
Ministry of Manpower Development, Youth and Employment (Factories Inspectorate Department)				
Ministry of Justice and Attorney General				
Ministry of Women and Children's Affairs				
Attorney-Generals' Department				
Judiciary				
Ministry of Interior				
Ghana Police Service				
Ministry of Defence				
Ghana Armed Forces				
Irrigation Development Authority of Ghana				
Ghana Association of Farmers and Fishermen				
Cocoa Services Division of Ghana COCOBOD				
Cocoa Research Institute of Ghana				
Pharmacy Council				
Association of Ghana Industries				
Electricity Company of Ghana				
Ghana Water Company Limited				
Volta River Authority				
Universities (UG, KNUST, UCC, UDS, UEW)				

Each of the institutions listed in Table 2.1 above has either a combination of management or regulatory functions. Their functions are often not coordinated, with some institutions experiencing conflicts in the execution of their duties leading to duplication of efforts, gaps in regulation and control and waste of resources.

2.2.3 Relevant International Commitments and Obligations

The Conference of Plenipotentiaries of the Stockholm Convention recognised existing Multi-lateral Environmental Agreements (MEAs) and programmes related to sound chemicals management. Table 2 provides the list of chemicals-related MEAs and their ratification status for Ghana:

Ghana participated fully during the negotiations of the above Conventions and has ratified all except the Bamako Convention. Measures are being taken to give effect to our obligations under these Conventions.

Table 2: Chemicals- Related MEAs and their Ratification Status for Ghana

No	Convention	Year of Ratification
1	Stockholm Convention on Persistent Organic Pollutants (POPs) (2001)	2003
2	The Rotterdam Convention on Prior Informed Consent (PIC) Procedure of certain Pesticides and Chemicals in International Trade (1998);	2003
3	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)	2003
4	Bamako Convention on the Control of Transboundary Movements of Hazardous Wastes (1991)	Not ratified
5	FAO International Code of Conduct for the Distribution and Use of Pesticides (as amended in 2003)	Adopted
6	ILO Convention on the Safety of Chemicals at the Workplace (1990)	Not ratified
7	The UN Convention on Substances that Deplete the Ozone Layer (Vienna Convention) (1985)	1989
8	Montreal Protocol on Substances that Deplete the Ozone Layer (1987)	1989
9	London Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer (1990)	1992
10	UN Chemicals Weapons Convention (1993)	1997

2.2.4 Description of Existing Legislation and Regulations addressing POPs (manufactured chemicals and unintentionally produced POPs)

The 1992 Constitution of Ghana provides the broad policy basis for the protection of the environment. The relevant sections are as follows:

- Economic Development - Article 36 (9): The State shall take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek co-operation with other states and bodies for the purposes of protecting the wider international environment for mankind.
- Economic Development - Article 36 (10): The State shall safeguard the health, safety and welfare of all persons in employment, and shall establish the basis for the full deployment of the creative potential of all Ghanaians.
- Duties of a Citizen - Article 41 (k): The exercise and enjoyment of rights and freedoms is inseparable from the performance of duties and obligations, and accordingly, it shall be the duty of every citizen to protect and safeguard the environment.

The Policy Statement on the Environment requires the State 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”.

The above expectation from the State requires a more comprehensive policy on toxic substances (including POPs) for the country. The existing POPs-related legislations in Ghana include the following:

- The Environmental Protection Agency Act, (Act 490) of 1994. This Act which established the Environmental Protection Agency, seeks among other things to control the volumes, types, constituents and effects of waste discharges, emissions, deposits or other sources of pollutants and/or substances which are hazardous or potentially dangerous to the quality of life, human health and the environment through the issuance of environmental permits and pollution abatement notices. Section 10 of the EPA Act establishes the Hazardous Chemicals Committee with the following functions:
 - monitor the use of hazardous chemicals by collecting information on the importation, exportation, manufacture, distribution, sale, use and disposal of such chemicals;
 - advise the Board and the Executive Director on the regulation and management of hazardous chemicals; and
 - perform such other functions relating to such chemicals as the Board or the Executive Director may determine.
- The Pesticides Control and Management Act, 1996 (Act 528), provides rules for registration, manufacturing, use, disposal and non-disclosure of information, classification, licensing, reporting, labelling and inspections of pesticides.

Although these laws are not specific to the POPs, they provide a framework for the management of all chemicals and pesticides, which includes POPs. Other chemical related laws in operation in the country with some relevance to POPs control and management include:

- The Food and Drugs Law, 1992, (PNDCL 305B) which was enacted to control the manufacture, import, export, distribution, sale, use and advertisement of foods, drugs, cosmetics, household chemicals and medical devices. Drugs, cosmetics and household chemicals are made from several chemical substances that may have a negative impact on health and environment if the manufacture, distribution and disposal are not controlled and managed properly.
- The Factories, Offices and Shops Act, (Act 328) 1970, which seeks to protect the health and safety of workers from the dangers posed by chemicals to employees in the working environment;
- The Standards Decree, 1973 (NRCD 173)
- The Draft Policy and Bill on Occupational Safety and Health, 2000 which seeks to ensure that measures are instituted to ensure the attainment of optimum health for workers in all occupations in Ghana.
- The Mercury Law, 1989
- The Minerals (Off-Shore) Regulations, 1962 (as amended)
- The Oil in Navigable Waters Act, 1964
- Infectious Disease Ordinance (Cap 78)
- The Prevention and Control of Pests and Diseases of Plants Act, 1965 (Act 307).
- Prevention of Damage by Pests Decree, 1968 (NLCD 245)
- Cocoa Industry Regulations, 1968 (NLCD 278).
- Merchant Shipping (Dangerous Goods) Rules, 1974 (LI 971)
- Customs, Excise and Preventive Service Law, 1992 (PNDCL 330)
- Local Government Act, 1992 (Act 458)
- Export and Import Act, 1995 (Act 528).
- Environmental Assessment Regulations, 1999 (LI 1652)

On the basis of the above-mentioned policies and laws, action has been instituted, since 1985, on the initial list of 12 POPs chemicals subject to control under the Stockholm Convention. Table 3 shows the current legal status of each of the 12 POPs.

Table 3: Status of POPs in Ghana

Name of Chemical	Current status/control action	Details e.g. reason for control action, remaining allowed uses, etc.
Aldrin	Banned since 1985	Chemical is persistent. Safer alternatives preferred.
Chlordane	Banned since 1985	Chemical is persistent. Safer alternatives preferred.
Dieldrin	Banned since 1985	Chemical is persistent. Safer alternatives preferred.
DDT	Banned since 1985	Chemical is persistent. Other cheaper and safer alternatives such as synthetic pyrethroids for insect control for public health and agriculture are preferred
Heptachlor	Banned since 1985	Chemical is persistent. Safer alternatives preferred.
Hexachlorobenzene	Banned since 1985	Chemical is persistent. Safer alternatives preferred.
Mirex	Banned since 1985	Chemical is persistent. Safer alternatives preferred.
Dioxins & Furans (PCDDs/PCDFs)	There is limited information on releases into the environment	-
Polychlorinated Biphenyls (PCBs)	Importation is prohibited. Still present in old transformers and capacitors	-
Toxaphene	Banned since 1985	Chemical is persistent. Safer alternatives preferred.

2.2.5 Identified Gaps

The 1992 Constitution; the National Environmental Policy and the various national laws that have a bearing on the environment provide the basis, theoretically to enable the country manage the production/manufacture, import/export, handling, distribution and use of POPs. However, there is an indication that much more needs to be done in the areas of policy review and enforcement. The following gaps have been identified:

- Ghana has officially banned the importation and use of all the nine (9) POPs pesticides. Safer alternatives, which are now on the market, should be encouraged. There is however limited capacity for registration, licensing, monitoring and analysis to control importation of POPs. There is therefore the need to strengthen the existing enforcement measures.
- The Stockholm Convention requires the prevention of the production and use of new pesticides, which exhibit POPs characteristics. The pesticide registration scheme under Act 528 takes cognisance of the ‘persistence criterion’ in registering pesticides. There is however inadequate capacity in Ghana to conduct tests to confirm the persistence of various chemicals in Ghana.
- An administrative Directive by the Electricity Company of Ghana Limited (ECG) banned the importation of PCBs and PCB-containing equipment into Ghana in 1972. An inventory of PCBs and possible PCB-containing equipment was conducted in 2006 and the results are as follows:
 - Majority of the equipment that tested positive were those manufactured before 1972;

- The quantity of PCB contaminated equipment is, however, not decreasing after 1985 as expected. This trend is probably due to cross contamination through the filtration process of mineral oil and topping up with PCB contaminated mineral oil;
- Majority of equipment found to contain pure PCBs were those installed after 1985. Most surprisingly, equipment installed as recently as 2003 were found to contain pure PCBs;
- Some of the equipment that tested positive for PCBs were located in sensitive areas such as schools, water treatment works, markets, hospitals and hotels with some of them unprotected.
- Currently the official importation of transformers and PCB-containing equipment into the country is not subject to EPA's control. It is therefore possible that transformers and other PCB-containing equipment enter the country without the necessary checks on the PCBs status of these items. The EPA could use provisions of Section 10 of the EPA Act to institute measures to control the importation of PCB-containing equipment. There is also the need to conduct a comprehensive inventory of the PCB status of all the estimated 12,000 transformers in Ghana since there is the potential for cross contamination from retrofitting and maintenance operations.
- There are no specific regulations to control the likely emissions of unintentional POPs from automobiles in the country and there appears to be no link between the National Environmental Policy and the importation of equipment including vehicles into the country.
- The collaboration between EPA and the Waste Management Departments of the District, Municipal and Metropolitan Assemblies is very weak. As a result, there is uncontrolled release of dioxins and furans into the environment through incineration of wastes.
- It is necessary that future Regulations on POPs should cover polyaromatic hydrocarbons (PAHs), TPH and phenols.

2.3 Key Approaches and Procedures for POPs Chemicals and Pesticides Management including Enforcement and Monitoring Requirements

2.3.1 Assessment of Capacity and Gaps of Relevant Institutions Involved in Sound Management of Chemicals

The national institutional capacity for the sound management of chemicals including POPs has been assessed. The relevant institutions and their mandates are as outlined below:

2.3.1.1 Environmental Protection Agency (EPA)

The Environmental Protection Agency Act of 1994 (Act 490) established the EPA. It has the mandate to regulate, coordinate and manage the environment. Section 2 of Act 490 spells out the functions of the EPA which include the following:

- To prescribe standards and guidelines relating to the pollution of air, water, land and other forms of environmental pollution including the discharge of toxic wastes and control of toxic substances;
- To promote research, surveys and analyses for the improvement and protection of the environment and the maintenance of sound ecological systems in Ghana;
- To coordinate the activities of such bodies as it considers appropriate for the purposes of controlling the generation, treatment, storage, transportation and disposal of industrial wastes.

Act 490 places the EPA in a unique position as a regulator and a manager of the environment. In the discharge of its functions, however, there are some conflicts and overlaps with existing institutions that have regulatory roles as far as chemicals management is concerned and there is the need for cooperation between the Agency and such institutions.

The Pesticides Control and Management Act, 1996 (Act 528) mandates the EPA to:

- Register pesticides (sections 1 – 16)
- Restrict and suspend the use of pesticides if necessary (section 14)

- License all categories of pesticide dealers (sections 7 – 30)
- Enforce Act 528 for the appropriate penalties to be applied (sections 31 – 37).

Act 528, which was passed before the Stockholm Convention, has a few gaps and requires amendment to make it more comprehensive. This Act is limited to pesticides and does not cover all of the ‘dirty dozen’.

The EPA of Ghana currently, has limited human resources and logistics to handle any enabling legislation to implement the Stockholm Convention. The Agency needs to work closely with other organisations and also be supported to expand and improve its human and material resource capacities.

2.3.1.2 Ghana Standards Board (GSB)

The Standards Decree, 1973 (NRCD 173) established the GSB. The GSB may be classified as both a regulator and user, in the assessment of the use and management of POPs in Ghana. The GSB has overall responsibility for quality infrastructure embracing Metrology, Standards, Testing and Quality Assurance (MSTQ). This ensures that goods and services are of acceptable quality for both local and international consumers. It is the standards, testing and quality assurance aspects of the GSB’s work that are relevant to the Stockholm Convention on POPs.

The functions of the GSB as contained in the Standards Decree, requires the Board to provide services that may be relevant to the control and management of POPs. The relevant sections are as follows:

Section 2 (d) empowers GSB to promote standards in public and industrial welfare, health and safety.

Section 3 (2) (b) empowers GSB to provide for examination and testing of goods, commodities, processes, and practices and for those purposes the Board may establish such laboratories and other facilities as it deems fit.

The word “goods” has an elastic definition under the Standards Decree. Once it is prescribed according to the Decree, the word “goods”, in fact, covers all products (including POPs).

The activities of GSB, that may be relevant to the control and management of POPs, are carried out through laboratory examination and testing of goods and provision of quality evaluation reports. An example is the routine analysis of fruits and vegetable for levels of pesticide residues to facilitate export of these products and also protect public health and safety.

In practice, there is a substantial level of cooperation between GSB and EPA. Pursuant to the provisions of Sections 4 and 10 of Act 490, GSB serves on the EPA Board (which is the Governing Body) and the Hazardous Chemicals Committee of the EPA. In the circumstances, GSB contributes directly to the control and management of POPs.

As a user, GSB uses some of the POPs, namely Aldrin, Endrin, Chlordane, Dieldrin, and DDT as Reference Standards for analytical purposes. GSB does not have direct enforcement powers in the control and management of POPs.

2.3.1.3 Food and Drugs Board (FDB)

The Food and Drugs Law, 1992, (PNDCL 305B) established the FDB and although Law 305B was enacted in 1992; it was not until 1997 that the FDB, as an organisation, was established. The FDB is classified as a regulator with mandate in the control and management of POPs in Ghana.

POPs are not specifically referred to in Law 305B. The word “*chemical substance*” is defined under the Law 305B as “*any substance or mixture of substances prepared, sold or represented for use as a germicide, an antiseptic, a disinfectant, a pesticide, an insecticide, a rodenticide, vermicide, or detergent.*”

Section 18 of Law 305B stipulates that no person shall manufacture, prepare, sell or supply, export or import into Ghana any chemical substance unless it has been registered with the FDB. From the above

provision, no chemical substance (and for that matter no POPs e.g. DDT) can be imported into Ghana unless it is registered with the FDB and the appropriate fees paid.

There is obviously an overlap in the regulatory functions of FDB and EPA, if considered in terms of Section 18 of Law 305B and Part 1 (i.e. Sections 1-16) of Act 528. In practice, however, FDB has restricted itself to the registration of chemicals substances used in homes such as mosquito coils and aerosol sprays. There is the urgent need to remove the overlap to make the provisions of the two laws unequivocal.

There is some level of coordination between FDB and EPA. Under *Section 29 (1) (j)* of Law 305B, EPA is a member of the Governing Board of FDB. *Sections 11, 13, 26 and 36 of Law 305B* deal with the Enforcement Powers of FDB.

Section 36: empowers authorised officer of FDB at any hour reasonable for the proper performance of his duty to open and examine any receptacle or package, which he believes, contains any household chemical substance. Such officers also have the power of seizure of such products.

Section 11: makes it an offence for any person to sell any household chemical substance (including pesticide) that has in or on it any substance that may cause injury to the health of the user.

Section 13: makes it an offence for any person to use or dispose of any household chemical substance (including pesticide) in a manner likely to cause contamination of food or water for human consumption or in a manner likely to be injurious or dangerous to the health of any person.

Section 26: prescribes a penalty for offences committed as either a fine or imprisonment or both.

2.3.1.4 Customs, Excise and Preventive Service (CEPS)

CEPS may be classified as a regulator in the control and management of POPs in Ghana. Section 27 of PNDCL 330 CEPS to make regulations that may prohibit the importation or exportation of such goods as may be prescribed.

Section 235 of PNDCL 330 gives powers to officers to search persons, premises and baggage and seize prohibited and un-customed goods. Section 38 of Act 528 specifies the role of CEPS in the enforcement of the provisions of the Act.

CEPS currently performs duties on behalf of EPA by examining documents and EPA certificates/permits to ensure that they cover the particular importation such as chemicals, plastic granules, meat products and agro-chemicals. Records of chemical import returns are submitted by CEPS to the EPA on a quarterly basis.

There is a high level of co-operation between CEPS and the EPA. Officers of CEPS serve on various technical committees of the EPA including the Hazardous Chemicals Committee, the Pesticide Technical Committee and other projects undertaken by EPA.

CEPS served on the National Co-coordinating Team of the Enabling Activities project to facilitate early action on the implementation of the Stockholm Convention on POPs.

CEPS does not have any specific regulation on POPs but the objectives and functions of CEPS and provisions in its Law ensure the monitoring of importation of chemicals including POPs into the country. It also ensures the enforcement of Regulations prescribed by the Government and its agencies.

2.3.1.5 Ministry of Food and Agriculture (MoFA)

The Ministry of Food and Agriculture has responsibility for regulating the use of pesticides in the country. The cash crop sector uses pesticides hence it doubles as a regulator and user. A recent research by the Plant Protection and Regulatory Services Directorate of MoFA (PPRSD/MoFA) confirmed the use of pesticides by the agricultural sector, especially in the control of diseases and pests in cocoa, fruits and vegetables and other cash crops.

In 1996 Ghana adopted FAO Code of Conduct for the distribution, storage and use of pesticides.

The PPRSD has a mandate to inspect or regulate specific agricultural products and also monitors the quality of agricultural inputs including pesticides and is involved in the appropriate use of agricultural chemicals.

2.3.1.6 Ghana Cocoa Board

The Ghana Cocoa Board (COCOBOD) of the Ministry of Finance and Economic Planning is in charge of cocoa buying and marketing in the country. Section 4 of the Cocoa Industry Regulation Decree 1968 (NLCD 278) for example, gives power to inspectors of COCOBOD to require any person in possession of or transporting or offering for sale any cocoa, to submit same for inspection. Other provisions in the decree concern checking the quality of cocoa beans before export. Agricultural officers were also trained to educate farmers on pesticide use.

2.3.1.7 Ghana National Petroleum Company (GNPC)

The Company is involved in oil exploration and drilling in the country and its functions have some bearing on the use of POPs but their establishment law does not address its activities with respect to POPs.

2.3.1.8 The Energy Sector

The Ministry of Energy and the Energy Commission regulate the institutions involved in crude oil processing, distribution and use. The activities of the Tema Oil Refinery (TOR) and Bulk Oil Storage and Transport (BOST) release unintentionally produced POPs.

2.3.1.9 Electricity Company of Ghana (ECG)

Most pre-1972 transformers and capacitors imported into the country by the ECG contain PCBs. Leakages sometimes occur with the resultant risk of contamination of terrestrial and aquatic environments. Though the Company officially banned the importation of PCB-containing equipment since 1972, there are some transformers countrywide from which some leakages have been observed.

2.3.1.10 Volta River Authority (VRA)

As a generator and supplier of the country's electrical energy, the VRA is a major user of transformers and capacitors. It has a major role in the management of PCBs and should therefore develop its human and institutional capacity to do that.

2.3.1.11 Department of Town and Country Planning

The Department does not directly use POPs but regulates the siting and accommodation of transformers and certain industrial establishments. It thus has a role in controlling the exposure of humans and/or environment to some contaminants.

2.3.1.12 National Poisons Information Centre

A Poisons Information Centre set up under the Ghana Health Service, partially fulfils the requirement of Article 10 of the Stockholm Convention for the establishment of information centres by countries to provide information on POPs and their alternatives to ensure public access to such information. It has the following key functions:

- Assists health professionals in the diagnosis and management of poisonings from chemicals (including POPs), toxins, venoms and drugs
- Provides information to health professionals on the toxic effects of poisoning agents
- To provide information to the general public on prevention and first aid management of acute poisoning
- Educates the general public on the damaging effects of chemicals on the environment
- Provides toxicological surveillance through data collection on chemical incidents, exposures and poisonings.

- Organises training on poisoning prevention and management for health workers and other relevant stakeholders including Pesticide Inspectors of PPRSD.

2.3.2 Current Sound Chemicals Management Programmes In Ghana

Ghana, through the then Environmental Protection Council (EPC), initiated a chemical monitoring programme in 1985. Under the programme, it was mandatory for all importers of all types of chemicals to obtain clearance permits from the Council before taking delivery of their consignments at the ports. Currently, the Chemicals Control and Management Centre (CCMC) of the EPA takes the lead role in all chemicals control and management issues in Ghana. The CCMC has as its primary objective, the protection of human health and the environment from the potential harmful effects of chemicals.

2.3.2.1 Industrial/Consumer Chemicals Management

Chemical clearance permits are still issued by the CCMC to importers of industrial chemicals as a means of regulating these chemicals especially the hazardous ones. It is mandatory for applicants to submit the Material Safety Data Sheets (MSDS) of every chemical they intend to import to the CCMC. These applications are then screened based on the information provided in the MSDS and other information obtained from secondary sources. Industrial/consumer chemicals, which have been listed on the Narcotics Control Board's red list or the EPA red list, due to their abuse in Ghana, are severely restricted. Samples of granular industrial raw materials such as fertilizers, polypropylene, high density polyethylene are sent to the Ghana Standards Board (GSB) for analysis, to ensure they are genuine as indicated before permits are issued for their clearance. The CCMC also supervises the disposal of obsolete chemicals in an environmentally sound manner.

2.3.2.2 Pesticides Management

The Pesticides Control and Management Act 1996, (Act 528) was enacted to improve the control and management of pesticides, including persistent organic pollutants, in Ghana. According to Section 1 of Act 528, no person shall import, export, manufacture, distribute, advertise or use any pesticides in Ghana unless the pesticide has been registered by the Environmental Protection Agency in accordance with the Act. The Pesticides Department of the CCMC undertakes the registration of pesticides and licensing of pesticides dealers, commercial pest control operators and pesticides storage facilities.

2.3.2.3 Hazardous Chemicals Management

The Environmental Protection Agency Act, 1994 (Act 490) provides for the establishment of a multi-stakeholder Hazardous Chemicals Committee. According to Section 10, paragraph 3 of the Act, the functions of the Hazardous Chemicals Committee are to:

- Monitor the use of hazardous chemicals by collecting information on the importation, exportation, manufacture, distribution, sale, use and disposal of such chemicals.
- Advise the Board and the Executive Director on the regulation and management of hazardous chemicals; and
- Perform such other functions relating to such chemicals as the Board or the Executive Director may determine.

The CCMC collects information on all chemicals (industrial chemicals and agrochemicals) imported into the country. The processing of applications for importation of chemicals are supported by documents such as the Material Safety Data Sheets or Technical Dossiers, which provide technical information on the chemicals. The documents may also suggest disposal options of such chemicals as well as information on their toxicity.

The disposal of obsolete or unwanted hazardous chemicals or wastes poses a great challenge for regulatory authorities in Ghana. The disposal of municipal and some types of chemical wastes are essentially carried out at landfill sites, which are not engineered. Incinerators for the disposal of some hazardous wastes are not available in Ghana. The improper disposal of chemical wastes into the environment may also result in long-term exposure of the population to pollutants that cause adverse health effects. The EPA currently has a procedure for the disposal or destruction of unwanted or obsolete hazardous wastes. The disposal covers all degraded, damaged, expired, and obsolete or otherwise unwanted chemical substances and products.

An organization or individual wishing to dispose of unwanted materials (industrial or commercial chemical wastes) applies to the EPA for both advice and permission. The application is accompanied by the following:

- A list stating the type(s) of substance(s), their quantities and origin of importation or manufacture.
- Material Safety Data Sheet (MSDs) or Technical Dossier or Label covering each substance or materials as appropriate.
- Description of the storage facility where the unwanted substances are stored etc.

Inspectors of the EPA then visit the premises to:

- Conduct visual inspection of the material to be disposed of to ascertain declared quantity, form, location and packaging.
- Collect samples of materials for analysis if necessary
- Request owner of material to provide such additional information as may be necessary for the proper classification of materials.

Based on the available information covering the material/substances; analysis results and inputs from experts, the inspection team recommends the appropriate mode of disposal/destruction or other measures such as repackaging and safe storage. The nature and characteristics of the wastes determines the suitable handling, destruction and disposal options taking into consideration all existing environmental and legal requirements.

The EPA also collaborates with a number of institutions in the destruction and disposal of unwanted materials. Such institutions include Ghana Standards Board, Food and Drugs Board, Municipal and District Waste Management Departments etc.

2.3.2.4 Chemical Information Exchange Network (CIEN) Project in Ghana

Information management is very vital in sound chemicals management but developing countries including Ghana faced with this challenge due to lack of modern information and communication technologies. In view of this challenge the United Nations Environment Programme (UNEP) Chemicals and the United States Environmental Protection Agency (USEPA) undertook a two-year project in Ghana that provided computers and training on accessing chemical information using the Internet.

The project catalysed the establishment of chemicals databases by EPA and other key national institutions as the basis of information exchange network among the main agencies involved in chemicals management. Some of the key institutions involved in the project are CEPS, MoFA, Ghana Standards Board.

2.3.2.5 Public Education

The CCMC periodically organises training workshops and seminars for stakeholders on the control and management of chemicals. Dealers in agrochemicals are also given refresher courses in pesticides management. The Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food

and Agriculture (MoFA) also organises training programs for pesticides dealers. The Ghana National Association of Farmers and Fishermen (GNAFF) is also represented at most training workshops organised by the EPA and the MoFA. The Agricultural Extension Officers of MoFA are also in direct contact with farmers and teach them among others the correct way to apply pesticides and fertilizers to their crops and also on the need to wear protective clothing when applying pesticides. Training of farmers focuses on FAO guidelines on the distribution and use of pesticides. The Pesticides Management Division of the PPRSD has prepared manuals on management of pesticides and these are used for training programmes. The manuals are also available to the public.

2.3.3 Assessment of the Monitoring, Research and Development Capacity in Ghana

Provision of relevant data/information is crucial for risk assessment/management of POPs. The following institutions in Ghana have the potential to develop and provide the necessary data/information for POPs management.

- University of Ghana, Legon
- University of Cape Coast, Cape Coast
- Kwame Nkrumah University of Science and Technology, Kumasi
- University of Development Studies, Tamale
- University of Education, Winneba
- Institutes of the Council for Scientific and Industrial Research (CSIR): Water Research Institute, Food Research Institute, Crops Research Institute and Soil Research Institute.

2.3.4 Identified Monitoring Gaps

PCBs and other unintentionally produced POPs are generated as a result of some industrial and human activities. They are also found in some industrial products such as paints, mineral oils, hydraulic fluids and plastics. For example Dioxins and Furans, which are generated as a result of indiscriminate bush and waste dump burning, are difficult to monitor. This therefore calls for the intensification of public awareness and greater cooperation among the relevant institutions.

2.4 Assessment of the POPs Issue in Ghana

2.4.1 Assessment with Respect to Annex A, Part I chemicals (POPs pesticides)

2.4.1.1 Past, Present and Projected Future Production and Use of POPs

Official importation of the nine (9) POPs pesticides have ceased since 1985. The results of the preliminary inventory carried out in 2003 showed that there are presently no official records on POPs pesticides in use in the country (see Table 2.4 for previous use of POPs pesticides in Ghana). Analytical investigation of organochlorine pesticides poisons of organs of human body and fluids have been conducted by the forensic science laboratory of the Ghana Standards Board in collaboration with the Department of Pathology at the University of Ghana Medical School. Out of 1215 toxicological cases examined between 1989 and 1997, 963 cases tested positive for chemical poisoning, 30% of which was directly related to the misuse of pesticides. From 1989-1997 there were 74 deaths, due to organochlorine pesticides poisoning. This and other reported incidents suggest that some of the organochlorine pesticides are still in use illegally and might include POPs pesticides.

Table 4 Previous Uses of POPs Pesticides in Ghana

No.	Name	Use
1	Chlordane	For termite control
2	DDT	Used widely in public health programmes for mosquito control
3	Aldrin	Insecticide against soil pests primarily termites, on cotton or corn and also for grain storage. Also used on cocoa
4	Dieldrin	Insecticide used on fruit, soil and seed crops, including corn and cotton. Also used on cocoa
5	Endrin	Rodenticide and insecticide used in cotton, rice and corn
6	Heptachlor	Insecticide used against soil insects, especially termites, also against mosquitoes.
7	Mirex	Insecticide used on ants and termites, also as a fire retardant
8	Toxaphene	Insecticide used against ticks and mites.
9	Hexachlorobenzene	Fungicide

2.4.1.2 Import and Export of POPs pesticides

Information gathered also indicates that POPs pesticides were generally imported into the country. Shell Agrochemical, which was a key pesticide distributor in the past, is currently not operating in Ghana. The exports of POPs pesticides appear to be non-existent. This stems from the fact that POPs pesticides used at the time were mainly imported.

As Ghana is a signatory to the Stockholm Convention, official or legal importation of POPs pesticides is prohibited.

2.4.1.3 Identified Stockpiles of POPs Pesticides and POPs Pesticides Waste

Results obtained from the countrywide inventory carried out did not record any stockpiles of POPs pesticides. However, there are unconfirmed reports of volumes of pesticides containers, which were buried at the premises of the Plant Protection and Regulatory Services Department (PPRS) at Pokuase in the Ga District of the Greater Accra Region as well as at the Tono and Veve Irrigation projects in the Upper East Region. It is alleged that the pesticides containers were buried in the early 1970's. There is therefore the probability that these containers might include POPs pesticides. Further work is required to investigate the issue and possibly locate the area and number of containers in order to carry out chemical analysis for identification purposes. This will also pave way for future work on evaluation of the extent of contamination and possible re-mediation.

The results of inventory carried out by PPRS as part of an FAO stockpile/obsolete pesticides project in 2000 indicates that there are seventy-two (72) metric tons of stockpiles/obsolete pesticides in Ghana. A number of the pesticides could not be identified due to lack of labeling, the conditions of the chemicals and absence of an analytical laboratory. The probability that these products may include POPs pesticides cannot be ruled out. To avoid possible cross contamination, all obsolete pesticides stockpiles and wastes will be analyzed for POPs content. Sites where the stockpiles are stored will require investigation for possible soil contamination.

2.4.1.4 Present Management (production, use, stockpiles and waste) of POPs Pesticides and Empty Containers

The Pesticides Control and Management Act (Act 528) of 1996 mandates the Ghana Environmental Protection Agency to regulate and manage the production, use of all pesticides including organochlorines as well as their stockpiles, waste and empty containers as contained in Part IV Section 39 of the Act (Annex II)..

2.4.1.5 Current Capacity and Experience in the field of POPs Pesticides

The current national capacity and practical experiences in pesticide management is in its preliminary stages. There are no specialized laws that control and manage POPs pesticides in Ghana but are partially dealt with under Act 528 (Pesticides Control and Management Act). There is also collaboration between the EPA, CEPS and PPRSD in the importation, monitoring and application of pesticides in general. Procedures and other capacities for POPs pesticides waste including empty containers are however lacking.

2.4.1.6 Assignment of Responsibility and Liability

A legal framework that may be applicable for assignment of responsibility and liability for the containment and disposal of POPs pesticides waste is not clearly spelt out in the Pesticides Control and Management Act (Act 528). It is expected that this will be covered under a separate regulations under Act 528. The Environmental Protection Agency Act (Act 490) of 1994, Part IV Section 28 Sub-Section 2 makes provision for the assignment of responsibility and liability (Annex b). This Act can therefore be evoked where necessary.

2.4.2 Assessment With Respect to Annex A, Part II Chemicals (Polychlorinated Biphenyls)

2.4.2.1 Current Regulations Pertaining to PCBs

There are currently no regulations pertaining to PCBs in Ghana. Inventories on production, export, import, use and distribution of polychlorinated biphenyls (PCBs) and PCB containing-equipment were conducted using UNEP guidelines on step-by-step approach to PCB identification. Facts available indicate that there is no production of PCBs in Ghana. PCBs applications by location were found to include, electric utilities (including distribution networks), industrial facilities, residential and commercial buildings, etc. In Ghana, the main potential PCB-containing applications at the target locations were found to be transformers and capacitors (closed applications). There is enough evidence to suggest that workers in some industries have been exposed to PCBs as a result of improper practices such as the use of empty transformer oil drums as water reservoirs. PCBs oils referred to as ‘dirty oil’ finds its way into small-scale industries where it is used to produce pomade and sold on the local markets for other application and purposes.

The Electricity Company of Ghana as well as the Volta River Authority and their clients (individual customers and industry) are the major custodian of PCB -containing equipment in Ghana. Evidence available indicates that the company officially ceased importing PCB-containing transformers and capacitors for use in Ghana since 1972.

Plasticizers, the largest group of open applications as are used in PVC (polyvinyl chloride) are a major source of PCB releases in Ghana. Additionally a number of open uses of PCBs in Ghana may include certain paints, fire retardants, adhesives, lubricants (such as brake linings, lubricating oils, cutting oils) Statistics on national imports and the nature of such imports (including quantity and type) are not available to allow the estimation of potential volumes of such uses.

2.4.2.2 Transformers

There are four hundred and fifty-five (455) pre-1972 possible PCB- containing transformers found countrywide. Most (85% or 386 out of the 455) of the transformers are housed in concrete and roofed buildings under lock and key. Additionally, the transformers are mounted on four walled- concrete slabs with concrete flooring filled with pebbles; thus preventing possible leaching and seepage of their contents outside the building in case of leakage. The transformers were in their original form with no signs of leakage and could continue to be used.

Further evidence indicates that some of these transformers had been retrofitted and filled with new dielectric fluid. Records of the type of dielectric and the procedure for filling were not available. Additionally some of the transformers had been topped up with some form of oil over the years. However, the frequency of top up as well as the type of oil used was not available.

Upon subjecting the contents of forty representative samples of each model of transformer (forty in all) to a simple density test it was concluded that, the transformer oil might not contain PCBs ($\geq 100\text{ppm}$); since in all forty tests, the oil sample floated on top of the water. PCB test kits will be employed in future field analysis.

2.4.2.3 Capacitors

In all, one hundred and forty seven (147) pieces of 11kV and 33kV possible PCB-containing capacitors were found at the Achimota and Tema power stations. Thirty-one (31) out of these decommissioned and discarded capacitors had been kept in a basement with concrete flooring at the Achimota Power Station. Some of the capacitor cans had broken at the insulator end whilst others had their cans bulging out. Most were leaking badly in a pool amidst a network of high-tension cables.

It has been found that, importation and use of semi-closed PCBs application equipment in the country is not properly monitored and documented. Discarded switches, voltage regulators etc. are scattered all over the country, particularly in electrical and factory workshops. Statistics were however not available to make any meaningful conclusions.

PCB- containing wastes were found at the Accra Central Station G- and the VRA materials stores at Tema. These are primary stations where broken down transformers from all over the country are repaired.

2.4.3 Assessment With Respect to Annex B Chemicals (DDT)

2.4.3.1 Past, Present and Projected Future Production, Import, Export and Use of DDT

DDT had been used extensively in Ghana in the past both for agriculture and public health purposes. The Ministry of Food and Agriculture, the Ghana Cocoa Board and the Ministry of Health appear to be the major importers of DDT before it was officially banned. DDT was officially used in agriculture as the main insecticide against cocoa capsids and for malaria and filariasis control programmes by the Ghana Cocoa Board and Ministry of Health respectively. There is general paucity of data on DDT import and application in Ghana. There is no information on export of any kind.

Information obtained from the Ministry of Health shows that in the late 1950s and the early 1960s, DDT was used for indoor residual treatment and malaria control in Ho, in the Volta Region. However, there are no available figures on quantities. Information obtained from the Cocoa Research Institute of Ghana (CRIG) at Tafo, indicates that, DDT was introduced in Ghana (then Gold Coast) after the Second World War and for use on cocoa farms. In 1944-1945, 2.5% DDT formulation was recommended for use

against capsids on cocoa since this formulation made excellent emulsion. Other DDT formulations that were used at the time were: (a). 10% DDT dusting powder- against mealy bugs and ants and (b). 25% DDT fog applied with smoke generators – against capsids and mealy bugs. Apart from the “Square Mile” area at CRIG (Tafo), DDT was also used extensively at Akwadum and Adonkwanta areas in Eastern Region. In the early 1950s DDT was replaced with Gamma-BHC (Lindane) and used extensively on cocoa in Ghana. Currently only chemicals that have been screened and recommended by the Cocoa Research Institute of Ghana are being used on cocoa by the Seed Production Unit of COCOBOD.

Information gathered from the Ghana Statistical Service indicates that there had been some unofficial importation of hexachlorobenzene and DDT into the country in the recent past (see table 5 below).

Table 5: Imports of Hexachlorobenzene and DDT

Year of Import	Area of Application	Pesticide(s)	Quantity/Kg	Country of Origin
2001	Not available	Hexachlorobenzene and DDT	20	Germany
2002	Not available	Hexachlorobenzene and DDT	10 800 200	Italy Egypt USA

SOURCE: GHANA STATISTICAL SERVICE

The source could not segregate the quantities into hexachlorobenzene and DDT. It could also be attributed to the fact that there was no proper monitoring in place to track down those quantities and other illegal importations into the country as the companies that imported the consignments also could not be identified. This could also account for the organochlorine poisonings discussed earlier on.

2.4.3.2 Identified Stockpiles of DDT and DDT Waste

There is no reliable information on stockpiles of DDT or DDT waste. There are unconfirmed reports of volumes of pesticides containers, which were buried at the premises of the Plant Protection and Regulatory Services Department (PPRSD) at Pokuase in the Ga District of the Greater Accra Region as well as at the Tono and Veve Irrigation projects in the Upper East Region. These pesticides may include DDT. The 72 metric tons of stockpiles/obsolete pesticides found in Ghana as indicated in the results of inventory carried out by PPRSD as part of an FAO stockpile/obsolete pesticides project in 2000 may also include DDT.

2.4.3.3 Present Management of DDT (production, use, stockpiles and waste) and Empty Containers

The Pesticides Control and Management Act (Act 528) of 1996 mandates the Ghana Environmental Protection Agency to regulate and manage the production and use of all pesticides including organochlorines as well as their stockpiles, waste and empty containers as contained in Part IV Section 39 of the Act (see Annex II). This is consistent with obligations as contained in Annex B.

2.4.3.4 Current Capacity and Experience in the Field of DDT and Alternatives

Since DDT was phased out, alternatives including Lindane (Gamma-BHC) and Uden (Propoxur) were used in the cocoa sector. Currently Gammalin 20EC (Lindane) and Uden have been replaced with safer alternatives including Confidor 200SL (Imidachloprid) and Akate Master (Bifenthrin). In the food crop sector, pesticides including Dursban (Chlorpyrifos) and Fipronil have replaced the organochlorines.

Information gathered from the Ghana Cocoa Board (COCOBOD) formerly Cocoa Marketing Board (CMB), which was the main agent at the time when DDT was in use indicate some level of experience.

The Seed Production Unit of COCOBOD for instance produces hybrid cocoa seedpods for sale to farmers for replanting. Confidor (Imidacloprid) and Akate Master (Bifenthrin) are the approved chemicals against cocoa capsids.

2.4.4 Assessment of Releases from Unintentional Production of Annex C Chemicals (PCDDs/PCDFs, HCB and PCBs)

2.4.4.1 Main Source Categories for PCDD/PCDF in Ghana

The potential main source categories for Dioxin and Furan and amount of releases in Ghana (in 2002) are summarized in Table 6 and in Figure 1 below.

Table 6: Potential Main Source Categories of PCDDs and PCDFs in Ghana

No	Main Source Categories	Annual Releases for 2002 (g TEQ/a)			
		Air	Water	Land	Residue
1	Waste Incineration	4.68	0.00	0.00	0.00
2	Ferrous and Non-Ferrous Metal Production	1.16	0.00	0.00	1.74
3	Power Generation and Heating	6.39	0.00	0.00	1.30
4	Mineral Production	0.00	0.00	0.00	0.00
5	Transport	1.37	0.00	0.00	0.00
6	Uncontrolled Combustion Processes	372	0.00	279	0.00
7	Production and Use of Chemicals and Consumer Goods	0.00	0.00	0.00	0.00
8.	Miscellaneous	0.03	0.00	0.00	0.00
9.	Disposal/Landfilling	0.00	0.12	0.00	0.00
10	Potential Hot Spots	-	-	-	-
1-9	Total	386	0.12	279	3.04

The standardized tool kit for identification and quantification of PCDDs and PCDFs developed by UNEP Chemicals (Draft 2001) was used and comprehensive data on the main sub-categories are as presented in Annex III.

2.4.4.2 Preliminary Assessment of PCDDs/PCDFs

The emissions of dioxins and furans to air, land, water and residue for ten sectors were assessed. The major sources of emissions are summarized in Table 5 above. Inventory estimates are based on measurements available in Ghana and on emission factors from international literature. Uncontrolled

combustion processes, medical incineration and power generation/heating were found to be the main sources of PCDDs/PCDFs in Ghana, for which also the most reliable data are available.

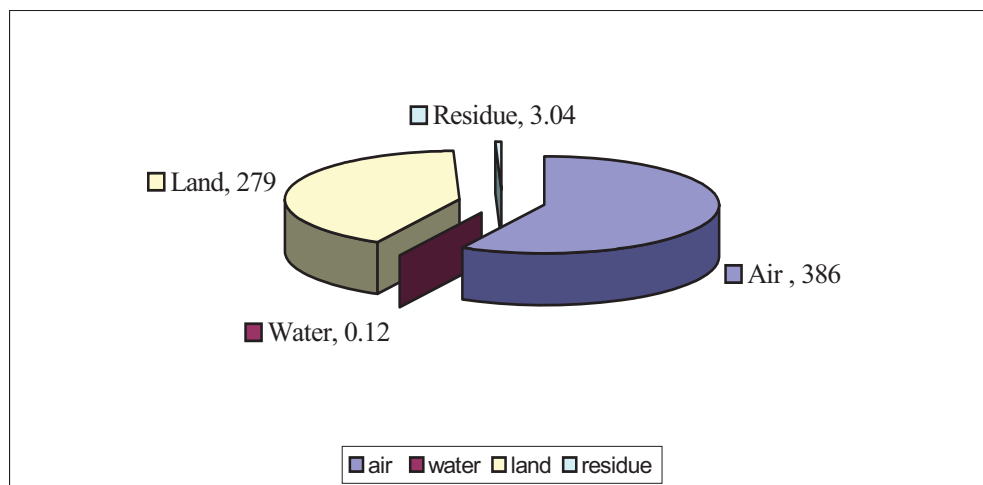


Figure 1: Annual Releases of PCDDs and PCDFs in Ghana for 2002 (g TEQ/a)

(a) Uncontrolled combustion processes

Uncontrolled combustion processes (particularly indiscriminate bush fires) were identified as the major source of PCDDs/PCDFs in Ghana in 2002. For an estimated total of 386 g TEQ of PCDDs/PCDFs emitted from known sources to air in the year 2002, the sector of uncontrolled combustion processes released a total of 371.2 g TEQ to air, corresponding to 96.2 % of the total emissions to air. Within the sector of uncontrolled combustion processes, emissions to air due to indiscriminate burning of forest fires, savannah grasslands and waste dumps were 218 g TEQ and 129 g TEQ and 24.2 g TEQ constituting 58.7 %, 34.8 % and 6.5 % respectively. The remaining amount of releases (14.8 g TEQ) from the main sources of PCDDs/PCDFs in 2002 was due to releases from power generation, medical waste incineration, transport and miscellaneous sources such as crematoria.

A total of 386 g TEQ of PCDDs/PCDFs was emitted from known sources to air in the year 2002. The sector of uncontrolled combustion processes released a total of 372.2 g TEQ to air corresponding to 94.5% of the total emissions to air. Within this sector, emissions to air due to indiscriminate burning of forest fires, savanna grasslands and waste dumps were 218g and 129g and 24.2 constituting 56.6%, 33.5% and 6.4% respectively. The remainder was due to release from power generation, waste incineration, transport and miscellaneous such as crematoria.

Additionally, a total of 279g TEQ of PCDDs/PCDFs was released to land from uncontrolled combustion processes. The breakdown for these emissions to land in 2002 was 175g TEQ (or 62.3%) from forest fires and 103g TEQ (37%) resulting from savanna grassland fires. Thus uncontrolled combustion processes, particularly bush fires have been identified as the major source of PCDDs/PCDFs releases in Ghana in 2002.

(b) Municipal Waste Dumps

Waste dumps are scattered all over the country. Leachate and runoffs and seepage from such dumpsites are potential sources of dioxin and furans releases into surface and ground water. The problem is envisaged to be more pronounced in the waste dumps located in the rain forest areas of Kumasi in the Ashanti Region and Takoradi in the Western Region.

(c) Transport Sector

The transport sector has been found to be a potential source that causes air pollution in the urban areas where vehicular traffic is a problem.

(d) Waste Oil

Most of the automobile repair garages in the country where cars and trucks are serviced are sites potentially contaminated with PCB waste oils. At these workshops, the oil discharged from the engines during routine auto-servicing are indiscriminately spilled thus contaminating the environment.

(e) Household Heating and Cooking

The traditional kitchens and cooking areas where biomasses, usually in the form of wood, are used as fuel are possibly contaminated by aerial releases of PCDDs/PCDFs. The populations of concern are the women who usually do the cooking.

(f) Open Water Dumping

The inventory identified points where industries discharge their effluents to surface water bodies as potential contaminated sites. Akosombo Textiles Limited according to the inventory discharges 0.48g TEQ of dioxins and furans into the environment.

2.3.4.3 Preliminary Assessment of HCB and PCBs

Releases of HCB and PCBs (Category 10e of the Dioxins and Furans Tool Kit) could not be assessed due to unavailability of reliable data at the time of inventorisation.

2.4.4.4 Measures in Place to control Releases and Options for further Release Reductions

Release of dioxins and furans to air and residue due to emissions from household heating (biomass) is currently being addressed indirectly through the promotion of a variety of gas fired stoves and ovens to meet the cooking and heating needs of the populace. The focus of these promotions is more towards checking deforestation through reduction in the use of fuel wood than the implementation of the Stockholm Convention.

Awareness raising on the harmful effects of dioxins and furans will precipitate public pressure for appropriate policy formulation on the need to reduce/eliminate PCDDs/PCDFs.

The available options for reduction in releases to air due to emissions from transport include the substitution of unleaded fuel for use in automobiles (which has been implemented since January 1, 2004) as well as the formulation of the appropriate policies. Releases due to uncontrolled burning which was the major source of PCDDs/PCDFs emissions in 2002 are also being curbed through on-going awareness creation programmes initiated several years ago. Evidence available in the course of data collection and collation indicates that in some parts of Ghana, incidences of bushfires in 2002 was 50% lower than that recorded in 1996- a clear indication of the effectiveness of on-going awareness raising programmes. It is therefore being suggested that the educational programmes be sustained and intensified.

2.4.4.5 Main Data Gaps and Their Perceived Importance

(a) Disposal/landfills

The management of municipal waste is a major issue in Ghana. This is evident from the numerous waste dumps scattered all over the country. Available statistics indicate that a total of 2,777.5 tonnes of waste is generated annually in Ghana. However, statistics on leachate and seepage from such waste dumps are not available, making it impossible to estimate emissions from waste dumps into water bodies. Considering the high annual rainfall in several areas in Ghana, measures must be put in place in the districts to collate data on seepage and leachate to facilitate estimation of releases into the country's water bodies.

Open water dumping is another source of potential release of PCDDs/PCDFs into the country's water bodies. Data on effluent emissions from industries, which are sited near main water bodies, are not available making it impossible to estimate releases from such sources. Strict enforcement of monitoring policies by the Environmental Protection Agency (EPA) of Ghana will compel industries to provide the relevant data for future measurements.

It is suggested that future environmental impact assessment (EIA) of new industries in Ghana should take into consideration, the potential of some industrial activities as sources of releases of dioxins and furans into the environment.

2.4.5 Information on State of Knowledge on Stockpiles, Contaminated Sites and Wastes, Identification, Likely Numbers, Relevant Regulations, Guidance, Remediation Measures, Data on Releases from Sites.

2.4.5.1 Institutional and Regulatory Framework for Contaminated Sites

Section 1e of Article 6 of the Stockholm Convention states that Parties would "endeavour to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annex A, B or C; if remediation of those sites is undertaken, it should be done in an environmentally sound manner."

In Ghana there is inadequate institutional and regulatory framework for the management of contaminated sites. Some of the difficulties in the development of suitable legislation include:

- Inadequate capacity to draft and promulgate such legislation;
- Fragmented nature of responsibility for management of chemicals and contaminated sites;
- Inadequate data and information that normally underpins such legislation;
- High cost of such an undertaking.

2.4.5.2 Current Capacity and Experience in the Management of Contaminated Sites

Currently there is inadequate capacity to identify contaminated sites and inadequate technical expertise to conduct laboratory analysis of POPs contaminated samples. There is therefore the urgent need for capacity building, institutional strengthening and training at all levels in the sound management of contaminated sites. Capacity building and institutional strengthening activities would include the following.

- Providing coordination support for harmonization, integration and mainstreaming of POPs contaminated sites management priorities and activities.
- Strengthening of participatory institutional mechanisms and capacity for contaminated sites management, planning and implementation with regard to site suitability analysis, assignment of responsibility and liability, at the national and local levels and across sectors.
- Strengthening skills for monitoring and enforcement of and/or compliance to environmental laws and regulations related to contaminated sites.
- Strengthening of information management systems to support decision-making at the regional, national and local communities' levels on contaminated sites.

2.4.5.3 Preliminary Identification of Priority Sites

In Ghana, the general nature of contaminated sites of concern includes such areas as the workplace, surface water and the air where victims of exposure are unaware of the presence and the consequent harmful effects of POPs. Indirect measures have to be taken to reduce the emissions of PCDD/PCDF into

the environment and to minimize human exposure. These require that sources of POPs are identified and quantified through a survey. The surveys on sources of POPs releases in Ghana covered were as follows.

- Areas where spillages occurred during filling of such equipment with PCBs
- Locations where electrical equipment (particularly transformers and capacitors) were serviced
- Poorly designed and maintained storage sites;
- Locations where POPs wastes were dumped;
- Waste discharges from chemical plants, where elemental chlorine is involved in the technology;
- Sewage sludge treatment plants; and
- Former organochlorine pesticides manufacturing/formulation plants

The priority areas of concern include the following:

- The immediate surrounding areas of the pre-1972 transformers countrywide
- The Electricity Company of Ghana Accra Central Station G (Mokola) and its environs
- Municipal waste dumps countrywide
- Open water discharges in main industrial cities and towns
- Pesticides contaminated sites including the premises of the PPRSD/MoFA, Pokuase in the Greater Accra Region, Abuakwa Formulation Plant, Kumasi in the Ashanti Region as well as the Veve and Tono Irrigation sites in the Upper East Region.
- Areas where obsolete stockpiles of pesticides and pesticides waste are being stored

(a) Areas Where Spillage Occurred During Filling of Electrical Equipment with PCBs

The immediate surroundings of the transformers are potential contaminated sites (see Plate 1). This is the result of spillage resulting from maintenance operations of the main utility service providers- ECG and the VRA: Samples are drained off twice every year to test the dielectric strength of the oil. Transformers are occasionally filled or topped up with oil some of which might be contaminated with PCBs.

Technicians who service these transformers are potentially at risk of inhaling PCBs through exposure. Currently there are 10 of such technicians for each of the ten regions in Ghana at every point in time giving a total of 100 persons potentially exposed countrywide at any particular time.



Plate 1: A contaminated site: Immediate environ of a transformer contaminated by spillage

(b) Locations Where Electrical Equipment (Particularly Transformers and Capacitors) Were/Are Serviced

PCB- containing wastes may also be found at the Accra Central Station G- a primary station where broken down transformers from all over the country are repaired (see Plate 2). Damaged transformers may result from several factors including burning due to lightning, or just the fact that they are old and have outlived their usefulness. Out of 100 burnt out transformers in 2002, 65 were due to lightning (Electricity Company of Ghana). At the repair workshop, the copper conductors in the damaged transformer are removed and the oil and/or PCBs content emptied into a poly tank reservoir and labeled “DIRTY OIL” and displayed conspicuously in the open. In the process there is spillage of PCBs/oils on the floor. Spills of the contents of the transformers could be found in choked drains around the building.

The choked drains around the building housing the transformers (see Plate 3) pose a more serious threat to a larger population. This is due to the fact that the Accra Central Power Station G is adjacent to the Central Mokola market, which attracts several thousands of traders and customers daily. Runoffs from the station during the rainy season may contaminate the entire market environment.



Plate 2: Technicians of the Electricity Company of Ghana at work in the transformer repair building



Plate 3: Drains around repair building choked with black contents of transformers

(c) Poorly Designed and Maintained Storage Sites

Available evidence indicates that the dirty oil reservoir (see Plate 4) at the Accra Central Station G has never been full over the years to require emptying due to lack of proper monitoring. The contents are unofficially and illegally sold out to:

- Enterprising women who illegally use the oil or possibly PCBs to formulate beauty creams for sale on the open market
- Welders for use in welding machines
- People who apply them as lubricants in domestic sewing machines
- Other entrepreneurs who mix it with sawdust for industrial and domestic use as fuel

The Material Stores at Tema is also another site with PCB contaminated wastes. The Volta River Authority (VRA) owns this storage facility. Unlike the Accra Central Stores, the waste oil or PCBs are stored in used drums. This waste is also disposed off illegally like that generated at the Accra Central Stores.



Plate 4: Displayed reservoir for PCB/oil waste at the Accra Central Power Station G

(d) Locations Where POPs Wastes Were/Are Dumped

The Electricity Company of Ghana has decommissioned and disconnected 147 capacitors from use. These are stored at two-capacitor banks- the Accra Power Station H at Achimota, and the Tema Station H at Tema. The Electricity Company of Ghana is the custodian of these capacitors. At the time of the inventory, some of the capacitors stored in the basement of the Achimota power station were leaking badly, thus contaminating the site (Plates 5 and 6).



Plate 5: Decommissioned and disconnected capacitors stored at capacitor banks at Achimota



PLATE 6: CAPACITORS BROKEN AT THE INSULATOR END OR BULGING OUT ON THE SIDES

2.4.6 Summary of Future Production, Use and Releases of POPs – Requirements for Exemptions

The current procedures for registration of pesticides and industrial chemicals give no room for the production of POPs pesticides (Annex A Part I and Annex B Chemicals) and other intentionally produced POPs (Annex A Part II Chemicals) in Ghana. Useful alternatives are also being sought to replace any chemicals with POPs characteristics, as such Ghana does not envisage requesting for any exemption for the listed chemicals.

The table below indicates the use of Annex A Part I chemicals (POP pesticides), Annex A Part II chemicals (PCBs) and Annex B chemical (DDT) in tonnes and unintentionally produced POPs in g-ITEQ.

Table 7: Projected POPs Production, Use and Unintentional releases

Year	2002/03 (Baseline Inventory)	2005	2010	2020	2030
POPs pesticides					
Production	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Aldrin	0.00	0.00	0.00	0.00	0.00
Chlordane	0.00	0.00	0.00	0.00	0.00
Dieldrin	0.00	0.00	0.00	0.00	0.00
Endrin	0.00	0.00	0.00	0.00	0.00
Heptachlor	0.00	0.00	0.00	0.00	0.00
Hexachlorobenzene	0.52	0.00	0.00	0.00	0.00
Mirex	0.00	0.00	0.00	0.00	0.00
Toxaphene	0.00	0.00	0.00	0.00	0.00
DDT					
Production	0.00	0.00	0.00	0.00	0.00
Use	0.52	0.00	0.00	0.00	0.00
PCB					
Production	0.00	0.00	0.00	0.00	0.00
Use					
Closed and Semi-Closed Applications	To be estimated	To be estimated	To be estimated	To be estimated	0.00
Open applications	To be estimated	To be estimated	To be estimated	To be estimated	0.00

TABLE 7 CONTINUED

Year	2002/03 (Baseline Inventory)	2005	2010	2020	2030
Releases From Unintentional Production	g –I TEQ	g-I TEQ	g-I TEQ	g-ITEQ	g-ITEQ
Dioxins And Furans					
Waste Incineration	4.68	To be estimated	To be estimated	To be estimated	To be estimated
Ferrous and Non Ferrous Metal Production	2.90	To be estimated	To be estimated	To be estimated	To be estimated
Power Generation and Heating	7.69	To be estimated	To be estimated	To be estimated	To be estimated
Production of Mineral Products	0.00	To be estimated	To be estimated	To be estimated	To be estimated
Transport	1.37	To be estimated	To be estimated	To be estimated	To be estimated
Uncontrolled Combustion Processes	651	To be estimated	To be estimated	To be estimated	To be estimated
Production and use of chemicals and consumer goods	0.00	To be estimated	To be estimated	To be estimated	To be estimated
Miscellaneous	0.03	To be estimated	To be estimated	To be estimated	To be estimated
Disposal/land filling	0.12	To be estimated	To be estimated	To be estimated	To be estimated
Potential hotspots	-	To be estimated	To be estimated	To be estimated	To be estimated
Hexachlorobenzene	-	To be estimated	To be estimated	To be estimated	To be estimated
PCBs	-	To be estimated	To be estimated	To be estimated	To be estimated

2.4.7 Existing Programmes for Monitoring of Releases, Environmental and Human Health Impacts, Including Findings

Article 11 of the Stockholm Convention places an obligation on countries to undertake appropriate research on POPs. Studies in this area are however sparse in Ghana. Currently there is no system for monitoring POPs releases in Ghana though the potential sources of POPs have been estimated. However, their impact on the population has to be estimated during the implementation of the NIP. There is the need for comprehensive analysis to be conducted to obtain an overall picture of the state of the environment and human health with regards to POPs releases.

2.4.7.1 Declaration and Reporting of Priority Pollutant Releases

The EPA has a system in place that mandates industrial establishments and other potential sources of pollutants to monitor and report on releases of priority pollutants. However these do not specifically address releases of POPs (see Annex IV-Draft National Environmental Quality Standards Regulations) to the environment due to inadequate laboratory infrastructure and analytical capability in the country.

2.4.7.2 Current Monitoring Activities

The EPA has in place air and water quality monitoring programmes, which focus on the following:

- Baseline environmental monitoring to establish the status of air and water quality;
- Periodic monitoring in selected areas to establish trends in environmental quality;
- Regular monitoring of effluent quality of industries.

The Agency is also collaborating with other stakeholders on a pilot programme to monitor emissions from vehicles. This programme is aimed at collecting and collating baseline vehicular exhaust emissions data for the development of vehicular exhaust emission standards and regulations. The programme forms part of the overall programme of improving urban and roadside air quality under the World Bank Clean Air Initiative for Sub-Saharan African cities. It is envisaged that the programme will be extended in future to measure emissions resulting from Annexes A and C chemicals (PCBs, HCBs and PCDDs/PCDFs), when the requisite capacity is developed.

The Water Research Institute of the Council for Scientific and Industrial Research (CSIR-WRI) is the lead institute that conducts regular monitoring of surface water bodies in the country and has extensive water quality data.

2.4.7.3 Other Monitoring Activities

(a) Epidemiological Studies

A field survey to examine the extent of pesticide associated symptoms in farmers involved in irrigation projects in Ghana (based on self-reporting of symptoms by farmers) revealed that 36% of interviewed farmers had experienced adverse effects after applying pesticides. The most significant symptoms included headache, dizziness, fever, blurred vision, and nausea / vomiting (Clarke et al, 1995).

Apart from this epidemiological study among farmers, and few case studies, there are no countrywide statistics on the extent of pesticide poisoning of farmers. Most of the existing information is based on knowledge, attitudes, practices and behaviour (KAPB) studies among farmers, which reveal the following.

- Farmers on selected sites have moderate levels of knowledge of the routes of exposure and of potential symptoms suffered from pesticide exposure. The knowledge of protective measures to combat health effects was non-conclusive but was suggestive of poor to moderate awareness of measures.

- Practices encouraging high exposures and risk of intoxication from pesticides include long duration of pesticide use coupled with frequent applications, storage of pesticides in the home, particularly bedrooms in pint size beer bottles, and short re-entry intervals. The use of wide range of pesticides mostly of moderate to high toxicity and cocktails suggests the need for control and monitoring at national and local levels.
- Farmers despite claiming knowledge of health risk from pesticides do not generally accede to the use of personal protective measures. The major reason given by workers as underlying their failure to use protective measures was financial hardship making the equipment unaffordable. Other important factors include the discomfort experienced in using protective clothing.

This research revealed lapses in knowledge, attitudes and practices of farm and industry workers with regard to the safe use of POPs pesticides and POPs industrial chemicals. The following are the records of monitoring carried out by some institutions, as they relate to POPs.

(b) Ghana Standards Board/ University of Ghana Medical School

One group of chemicals analyzed are the organochlorine pesticides of which a majority are listed as POPs. Analysis of human organs and fluids, foods and drinks at the Forensic Science Laboratory of Ghana Standards Board in collaboration with the Department of Pathology at the University of Ghana Medical School provide the following results: Out of 1215 toxicological cases examined between 1989 and 1997, 963 cases tested positive for chemical poisoning, 30% of which was directly related to the misuse of pesticides. From 1988-1997 there were 74 deaths, due to organochlorine pesticides and 77 up to 2002.

From results obtained, it can be observed that the incidence of organochlorine poisoning was high during the years 1989-1992. There was a reduction from 1993-1995 and there was a significant increase in 1997. From 1998 to 2002, there was a decrease in organochlorine poisoning.

The laboratory has had a problem with getting appropriate reference standards of the metabolites of the organochlorines (POPs) under review. The laboratory therefore identifies the classes of pesticides. It is envisaged that now that the monitoring of pesticide residue in fruits and vegetables has been assigned to GSB, the laboratory will soon be in a position to identify specific pesticides, which are used as agents for poisoning recast and make it scientific.

(c) Ecolab/UG/ KNUST/CSIR-WRI/GAEC/UCC

Some research has been undertaken and further studies can be carried out. Some of these are in the area of POPs, others not specifically part of the Dirty Dozen and these include the following research thesis.

- The Persistence of pesticides, (Lindane and Endosulfan) and their effect on maize grown in two soil ecosystems. (Osafu, S. and Frimpong, E. (1998).
- Lindane and Endosulfan residues in water and fish in the Ashanti Region of Ghana. *Journal of the Ghana Science Association*.
- Monitoring of pesticide contamination in farming areas in Ghana. Council for Scientific and Industrial Research-Water Research Institute (CSIR-WRI) Annual Report 2000.

The project aimed at eliciting epidemiological evidence to suggest health implications of indiscriminate pesticide use in Ghana. The focus of activities was the analysis of environmental samples and human body fluids for organochlorine residues. Investigations were therefore conducted on the use of pesticides in tomato farming at Akomadan. The results of the investigations revealed that Lindane and Endosulfan occurred in both water and sediments whilst other organochlorine pesticide residues such as Hexachlorobenzene (HCB), p,p-DDE and Heptachlor Epoxide occurred additionally in sediments. Heptachlor Epoxide was the only organochlorine residue detected in appreciable quantity in tomato crops. Significantly, higher HCB and p,p-DDE residues were found in human blood and milk samples. The mean values of HCB and p,p-DDE in blood were 30ug/kg and 380ug/kg respectively. The mean values

of HCB and p,p-DDE in milk were 40ug/kg fat (1.75g/kg whole milk) and 490ug/kg fat (17.15ug/kg whole milk respectively).

- Pesticide Residue analysis on Anloga shallot fields using brine shrimp lethality test (Lumor, S. K. E. June 2001). Samples of soil, water and shallots were analysed for pesticide residues. More pesticides residues were extracted from soil samples as compared to shallots and water. Residues from soil also showed higher activity than residues from water and shallot.
- Persistence and fate of ¹⁴C-Lindane applied to Soil in a Maize Ecosystem. In *Environmental Behaviour of Crop Protection Chemicals*. Proceedings of an International Symposium on the use of Nuclear and Related Techniques for studying the behaviour of Crop Protection Chemicals IAEA-SM-343/23. Vienna 163-170 (1997) (P. O. Yeboah, K. G. Montford, F. E. Appoh and D. K. Dodoo). ¹⁴C-Lindane was applied to soil surface in a maize ecosystem (one month after planting) was taken up by the plant. Within the first 25 days of treatment, ¹⁴C-Lindane or its metabolites were found within the entire plants with the greatest concentration in the lower leaves; and a sharp build up of Lindane concentration towards the tip of each leaf. Radioactivity and hence pesticide concentration was uniformly distributed in the plant with time, to the extent that measurable levels were detected in the tassel cob and the grain. This indicated that soil-applied ¹⁴C-Lindane dissipates faster in soils of lower organic matter content. The levels of surface applied ¹⁴C-Lindane that was bound in the soil increased with time and also with increasing organic matter content. Radioactivity was associated mainly with the topsoil layer (0-3cm).
- Seed yield and Residue levels of Endosulfan in Asutem cowpeas following Cypermethrin and Endosulfan treatments. Proceedings of First National Workshop on Food and Industrial Crop Protection, 141-145. (Montford K. G., Yeboah P. O. and Klake R. K.). Asutem cultivar of cowpea was sown to two plots each measuring 50m x 50m. Endosulfan marketed as Thiodan 3EC was applied at a rate of 0.7kg/ai. 53 Days after planting following two successive treatments with Cypermethrin at 50g/ai the mean Endosulfan residue level of 0.05µg/kg detected on seeds from treated plots at harvest time was lower than the recommended permissible level of the FAO.
- Evaluation of XE-340 as a Trapping Medium for Airborne Organochlorine Pesticides. Bulletin of Environmental Contamination and Toxicology 33. 13-29 (1984). (Philip O. Yeboah and Wendel Kilgore).
- Evaluation of XE-340 as a Trapping Medium for Airborne Organochlorine Pesticides. XE-340 resin has been demonstrated as an effective medium of trapping such chlorinated organochlorine (e.g. Chlordane, Lindane Heptachlor, Aldrin and Dieldrin) in air.
- Comparative studies of pollution-induced microsomal NADPH-dependent cytochrome P-450 monooxygenase enzyme complex of tilapia species (Lambert, Y. F. 1994). Studies investigated the exposure of effluents from Akosombo Textiles Ltd. (ATL) on two economically important tilapia species. Results indicated that there was no relationship between exposures to the pollutants. On the other hand, there was a relationship between exposure to ATL effluents and the health status of the fishes.
- Cytochrome P-450 monooxygenase complex and glutathione-S-transferase in Sarotherodon melanotheron as biomarkers of pollution. (Renner, C. 1998).
- Organochlorine Pesticide and PCB residues in plant foliage (*Mangnifera indica*) from West Africa (Bacci E. et al 1988). Mango leaves at the end of their natural cycle, collected in 71 sites of 5 different countries were used for a study on the contamination by chlorinated insecticides (Lindane, p,p' DDT and related compounds), HCB and PCBs in terrestrial ecosystems of West Africa. The role of this region in the global circulation of these contaminants is briefly discussed. The results indicated that PCBs were identifiable and quantifiable together with other insecticide and HCB residues in one rare sample; however, undetectable or exceptionally very low levels of HCB and PCBs characterized all other samples. For HCBs, DDT and its derivatives, the levels were high, or at the very least, detectable.

- Pesticides in the Lake Volta. Results of analysis of samples of lake water showed the presence of α -endosulfan, β -endosulfan, HCB, Lindane, p,p-DDT, p,p-DDE and p,p-DDD. The presence of such chemicals, though below allowable limits for drinking water purposes, is an indication of the increasing application of pesticides in large-scale agriculture in the catchment areas of the Volta Lake (Environmental Impacts Assessment, Volta Lake Debre Shoals Removal and Maintenance Dredging Project).
- Pesticides Concentrations in Fishes in Lake Volta. Fishes caught in the environs of dredging sites of the Volta Lake were analysed for the presence of pesticides in their bodies. The analysis showed substantial amounts of HCB, α -endosulfan, β -endosulfan, Lindane, p,p-DDT, p,p-DDE and p,p-DDD. (Environmental Impacts Assessment, Volta Lake Debre Shoals Removal & maintenance dredging Project).

2.4.8 Current Level of Information, Awareness and Education among Target Groups; Existing Systems to Communicate Such Information to the Various Groups; Mechanism for Information Exchange with Other Parties to the Convention

2.4.8.1 Overview of the Mechanisms in Place to Convey Environmental and Chemicals Related Information to the Public

According to Ghana's Environmental Action Plan, the success of any environmental policy depends on the fact that all sections of the population understand the functioning of the environment and the problems it presents. The implication of this is that Environmental Education should reach all sectors of the community. To this end, continuous and detailed education programmes are being implemented at all levels of society so that every Ghanaian becomes aware of the problem and fully assumes responsibility in safeguarding the environment. In the formal system, Environmental Education has been integrated into the curriculum of schools.

In the non-formal system, sustained efforts are being made to promote awareness among policy makers to provide training for resource managers at appropriate levels, and promote greater public awareness and motivation for environmental action. Indeed there are sectors responsible for providing education in all forms throughout the country. Some of the institutions and organisations, which have various means of disseminating environmental and chemicals related information to the public, include the following:

- Non Governmental Organisations (NGOs), Community Based Organisations (CBOs)
- Ghana Education Service
- District Assemblies
- Media
- Religious Organisations or Faith Based Organisations
- Universities and Research Institutions
- Traditional Institutions

(a) NGOs

Various NGOs operate in the environment sector in the country and create awareness through their activities. Currently, about two hundred NGOs have registered with the EPA. This number keeps on rising as more and more NGOs are formed. However, out of this number only about 30% are active. The NGOs who are in touch with the local people at the grassroots reach the people through various inter-personal contacts. Some have Newsletters through which they reach the reading public, for example, the Green Dove of the Green Earth Organization and the Friends of the Earth (FOE) Line for the Friends of the Earth and Nko for the Ghana Wildlife Society, Evergreen News by the Evergreen Club of Ghana (ECOG). All active NGOs have field officers in their project communities who raise awareness in their

areas (see Annex V for the list of active NGOs registered with the Environmental Protection Agency with their address and contact persons).

(b) Ghana Education Service

During the development of the Environmental Action Plan, the EPA in collaboration with the Ghana Education Service (GES) integrated environmental education into the syllabuses of schools in the form of themes and topics related to the environment. Teachers are supposed to teach these topics and themes. Through teaching, the students serve as agents of information to their parents or adults and their siblings.

In Ghana, through the Free Compulsory Universal Basic Education (FCUBE), all children of school going age irrespective of their religious and social circumstances or physical constraints are mandated to be in school. Currently, the literacy rate in Ghana is 68%. It is expected that through the successful implementation of the FCUBE, the literacy rate would increase significantly. On the average, about 240,000 children are presented to write the Basic Education Certificate Examinations (BECE) every year. Of this number, about 60% qualify to enter senior secondary schools in the country.

(c) District Assemblies

District Environmental Management Committees (DEMCs) have been formed within each District/Municipal/Metropolitan Assembly. The DEMCs are responsible for mobilising and educating the people for sound environmental management practices. The District Assemblies, being the highest political bodies in the communities, have various means of reaching their local people; they have Assemblymen and women and other Unit Committee representatives who meet constantly. However, not all DEMCs are active but it is easy to reactivate the dormant DEMCs. Some of the District Assemblies implement projects in the environment sector.

(d) Media

There is currently an unprecedented realisation of the importance of the media in creating awareness on various issues including the environment in Ghana. Both electronic and print media are heavily patronised in Ghana. Currently, there are 5 main state owned newspapers-3 dailies and 2 weeklies, namely the Daily Graphic, Ghanaian Times and Evening News (dailies); and the Mirror and the Spectator (weeklies). There are also over 50 private papers being published in the country. Editorials and features placed in these dailies create awareness on environmental issues.

Currently, every region has its own FM station in addition to the national radio station GBC 1 and GBC 2, which transmit, to the whole country. Accra alone has about 10 FM stations while Kumasi has 4. Many people listen to radio anytime during the day even when they are working. It is common to see people listening to radio programmes in offices, shops, markets and even on the farm. This listening culture has been accentuated by the use of local languages and dialects.

Government and private media journalists serve as channels for public information on the management of the environment that the general public needs to know. The EPA and other environment related institutions such as the Forestry Commission have been involving journalists as active participants in workshops and seminars to create awareness.

Advertisements, jingles and environmental messages are played on radio and television. Radio and television discussions and interviews on environmental topics are held to provide information to the public as well as raising awareness on related environmental issues. Some of the programmes are:

- Public Concern in English on Ghana Television (GTV)
- Mmaa Nkomo in Akan on GTV
- Adult Education in six local languages on GTV
- Farmers Forum in English and Akan.

Documentaries on environmental issues are also screened on television. Billboards carrying environmental messages are placed at vantage points. Stakeholders organise seminars, workshops, meetings and durbars. During such gatherings, information prepared is circulated among the public at the gatherings and the press also publicise these for the information of people who did not participate. Public participation in environmental impact assessment (EIA) also ensures that information about the environment get to the people. This is done through meetings, focus group discussions and at fora called public hearings where people and interest groups in a particular community where a project is to be located are given the opportunity to express their opinions and ideas on the environmental aspect of the project.

(e) Religious Bodies/Faith-Based Organisations

Many religious bodies have departments for development and environment. For example the Christian Council with about a membership of 15 denominations has a Development and Environment Department. The Department has environment, health, agro-forestry and sustainable agriculture programmes. The Environment and Health programme unit among other things organises educational programmes through church development groups. The Catholic Church supports and encourages communities to go into agro-forestry. The church has agro-forestry projects in all the dioceses in the country. The church also has NGOs operating in the environment sector, which are responsible for the environmental projects. These are, the Centre for Human Development and the Eco Office.

(f) Universities and other Research Institutions

Many departments in the universities offer courses, which have some relation to the conservation and/or preservation of the environment, that lead to the creation of environmental awareness. The University of Cape Coast offers courses in Environmental Science, and Environmental Education and Agricultural Science; the University of Ghana offers courses in Environmental Law, Environmental Science and Agricultural Science; the Kwame Nkrumah University of Science and Technology runs courses in Natural Resource Management, Agricultural Engineering, Horticulture, Biological Science, Environmental Science etc. The University of Education and University of Development Studies also offer environment-related courses.

(g) Traditional Institutions

It is evident that there is some awareness of the value of the environment and the need for its conservation, protection and management in the traditional value systems. In this context, the people see themselves as part of the natural environment whose proper management and well being is essential for their existence and further development.

In the coastal communities, it is forbidden to go out fishing on Tuesdays. This reduces pressure on the demand for fish by fishermen and thereby serves as a means of conservation. In the forest areas some days have been set aside when no farming activities take place. This also serves to reduce the pressure on the clearing of the vegetation and therefore preserve bio-diversity.

Equally important, some groves in the country have been declared sacred. It is therefore against the gods to enter them without permission from the elders or fell any tree in those forests. These and other environmental protection methods have been handed over from generation to generation through informal traditional educational methods such as proverbs, totems, festivals etc.

In Ghanaian culture, chiefs are well respected in the community. The local people will be more comfortable with messages from their chiefs. In this case, farmers and chiefs from POPs identified communities would need to be sensitized about issues regarding POPs and their co-operation sought in the implementation of the project. The sensitization will involve assisting the chiefs to identify the issues/problem, the causes and effect of the problem, what the current situation is, what will happen if nothing is done about the situation and what should be done.

(h) Environmental Impact Assessment (EIA) In Ghana

In Ghana, developments (proponents) who want to carry out some undertakings are required by the Environmental Assessment Regulations of 1999 (LI1652), to register and undertake an appropriate level of environmental assessment of their projects. The Regulations provide a list of the projects for which environmental impact assessment (EIA) is mandatory before commencement of work.

The regulation encompasses projects for which EIA is mandatory. It includes agriculture, drainage and irrigation, airports, land reclamation, fisheries, forestry, housing, ports, petroleum, power generation and transmission, water supply, chemical and metal industry, and large-scale mining. Every undertaking/development that may have an impact on the environment is therefore required to be registered with the EPA.

2.4.8.2 Specific Practices by Government and Stakeholders in Ensuring Public Awareness and Involvement

Nationally, the government public information policy and practice related to the environment have been embedded in various laws and legislation as well as the 1992 constitution. The major ones are Act 490, LI1652 and Act 528. Additionally, some institutional policies on the environment, forest, etc have been documented. Section 2 of Act 490 spells out the functions of the Environmental Protection Agency in relation to education, information and awareness creation. These are as follows.

- Initiate and pursue formal and non-formal education programmes for the creation of public awareness of the environment and its importance to the economic and social life of the country.
- Develop a comprehensive database on the environment and environment protection for information of the public.
- Conduct seminars and training programmes and gather and publish reports and information relating to the environment.

In the formal system, the EPA in collaboration with the Ministry of Education integrated Environmental Education into the syllabus of schools. Environmental themes/topics are therefore taught in schools and colleges. In connection with the development of databases on the environment, the EPA has the following among others:

- Ghana Environmental Database (GHANED): GHANED gives the sources of information on environmental issues including chemicals and POPs. The information involves titles of documents and authors and the location of such documents.
- NGO database: The database on the NGOs includes the names of the NGOs, their location, contact persons, address and their activities
- Soil Data Base Management: This database involves soil attribute data for 789 soil profiles stored in soil database.

In the non-formal sector, the EPA conducts seminars, training, publishes reports on the environment, publishes newsletters and carries out environmental awareness campaigns to the general public including exhibitions.

2.4.8.3 Tools and Techniques for Disseminating Environmental and Chemicals Related Information

UNEP Governing Council Decision 19/GC, adopted in 1997, promotes international action to protect human health and the environment through measures to reduce and eliminate releases of persistent organic pollutants (POPs). The decision also calls for immediate actions including improved availability of information on alternatives to POPs. To help achieve these laudable goals, there is the need to develop effective information dissemination tools related to chemicals. These information dissemination tools,

should involve a well-defined strategy, which is consistent and coherent with National Environmental Policy and Action Programmes as follows:

- Magazines
- Newsletters
- Reports
- Journals
- Brochures
- Flyers
- Newspapers
- Radio/TV
- Posters
- Billboards
- Internet
- Stickers
- Public Fora
- T-Shirts and Souvenirs

The techniques and mechanisms, which employ these tools to disseminate environmental and chemicals related information, include among others:

- Seminars, Workshops and Symposia
- Durbars
- Publications
- Teaching
- Interviews on Radio/TV
- Discussion on Radio/TV
- Advertisements on Radio/TV
- Presentation of messages on Billboards and posters
- Jingles
- Radio/TV drama
- Focused group meetings
- Festivals and anniversary celebrations
- Press Releases
- Presentation of statements on the floor of Parliament by Members of Parliament (MPs) on chemicals including POPs.
- Religious meetings
- Essay competition for schools and colleges
- Songs

There are specific tools, techniques and mechanisms for disseminating environmental and chemicals related information in some organizations and NGOs.

2.4.8.4 Education and Awareness Creation Campaign Strategy for the Sound Management of Chemicals in Ghana

The use of chemicals probably including POPs for agriculture, public health and industrial purposes has increased over recent decades in Ghana. Benefits derived from the use of chemicals include increased

agricultural productivity, improved quality of life, disease control and protection of the environment. Best practice shows that chemicals can be used widely, cost effectively, and with a high degree of safety.

In Ghana there is enough evidence to suggest that best practice is very often not followed due to the general lack of knowledge and information on the potential hazards and risks of chemicals on human health and the environment and has led to mismanagement and misapplication. There is therefore the need to sensitise and educate the general population, especially end-users on the sound management of chemicals. An effective education and awareness programme will minimise the potential adverse impacts of chemicals on human health and the environment whilst maximising their benefits.

The overall objective of this programme is to develop and implement effective information and communication strategy for the sound management of chemicals in Ghana and the specific objectives are as follows:

- a) To develop and produce awareness creation materials for the general public and training manuals for specific professionals on sound management of chemicals;
- b) To create awareness among policy/decision makers and opinion leaders on sound management of chemicals;
- c) To provide the general public, target groups and resource persons with information on the potential hazards and risks of chemicals on human health, the environment and measures to promote safe use;
- d) To train the end users on best practices (handling, storage, transport and disposal).

2.4.8.5 Mechanism for the Exchange of Information among Parties of the Convention

The exchange of information among parties to the Convention is crucial to the successful implementation of the NIP. This is important in view of the fact that some of the Parties to the Convention have more experience in the management of POPs in terms of financial, technical and technological aspects. It is therefore vital that effective mechanisms and channels of communication are established for the mutual benefit of all Parties. Presently, such mechanisms for the exchange of information with other Parties have not been officially established. Generally, the existing methods adopted include non-formal and formal interactions, bilateral arrangements, visits and correspondences.

An attempt has been made through the Chemical Information Exchange Network (CIEN) Project under the auspices of the United Nations Environment Programme (UNEP) and the United States Environmental Protection Agency (USEPA) to develop the capacity for chemical information exchange among Parties to the Convention, particularly the developing country Parties. One of the key aims of this project is to enhance the capacities of countries to obtain and share information needed for their national decision-making especially in the field of chemicals management.

Ghana hopes to exploit all available technologies and strategies to establish an effective and functional communication system for the smooth exchange of information with other Parties to the Convention.

2.4.9 Relevant Activities of Non-Governmental Stakeholders

As indicated in section 2.3.8.1 (a) various NGOs operate in the environment sector in the country and create awareness through their activities. Some have newsletters, brochures, posters, leaflets and information bulletins through which they reach the reading public. In addition to creating awareness, the NGOs engage in advocacy, training workshops, and small environmental related project in schools and local communities. The local population at the grassroots is reached mainly through inter-personal contacts, round table discussion on environment and public meetings.

Communication between EPA as the POPs focal point and the NGOs is maintained by both the inclusion of representatives of some of the NGOs on the National Coordinating Team (NCT) as well as sub-committees and also by active participation in workshops and other POPs related activities. Due to inadequate logistics and expertise, activities of these NGOs are mainly of a general nature and where specific, they are mostly related to issue regarding natural resource management (see Annex V for the list of active NGOs registered with the Environmental Protection Agency, with their addresses, contact persons and activities).

2.4.10 Overview of Technical Infrastructure for POPs Assessment, Measurement, Analysis, Alternatives and Prevention Measures Management, Research and Development – Linkage to International Programme and Projects

2.4.10.1 Waste Management Facilities

Waste management systems in the country are underdeveloped. There are inadequate sanitary landfills for the proper disposal of waste of all categories. A few of the major hospitals such as the Korle Bu and Komfo Anokye Teaching Hospitals employ simple batch incinerators to manage health care waste. Most categories of waste are collected in a largely uncoordinated manner and deposited at dumpsites and left to naturally rot or in some cases burnt. The numerous waste dumps scattered all over the country is evident of the level of the magnitude of the problem of poor waste management in Ghana.

2.3.10.2 Capability and Infrastructure for Contaminated sites Remediation

In Ghana the infrastructure and capability for the remediation of contaminated sites are underdeveloped. The inventory of contaminated sites identified some sites, which require urgent attention. There is therefore the need to build capacities and develop the requisite infrastructure to manage contaminated sites in the country. Relevant national stakeholder institutions have a major role to play in the development of capacity for contaminated sites management, including remediation. The roles that would be played by such institutions within the framework of NIP implementation would include:

- Enhancement of their capabilities for the assessment of POPs contaminated sites and remediation;
- Research on appropriate scientific methods for identification of contaminated sites and guidelines for remediation;
- Provision of information on Best Available Techniques (BAT) and Best Environmental Practices (BEP) for POPs contaminated sites remediation.

2.4.10.3 Capacity and Infrastructure for Environmental Monitoring

Monitoring of POPs in the environment, food, feed and humans is virtually non-existent in the country. The following organizations though not concerned primarily with the identification of POPs deal with pesticide analysis in the course of their work.

- Ecological laboratory (ECOLAB) at the University of Ghana. This laboratory set up with DANIDA's support is mainly concerned with research work in the area of pesticides. The laboratory is currently involved in research work in the area of pesticide residue analysis.
- Ghana Standards Board: The Forensic Science Laboratory is charged with the analysis of organic and inorganic poisons which includes pesticides in post-mortem tissues, foods drinks etc. The laboratory provides forensic toxicology services to the Ministry of Health. Though the Food and Agriculture Department of the Ghana Standards Board has been mandated by the Government of Ghana to undertake the monitoring of pesticide residue analysis in fruits and vegetables in the country, this has not yet taken off. Though the Board (through the World Bank and USAID) has acquired two Gas Chromatograph equipment for this purpose, it is waiting to acquire some logistics before monitoring commences.
- Plant Protection and Regulatory Services Directorate (PPRSD) Ministry of Food and Agriculture, with assistance from GTZ, pesticides residue in fruits and vegetables is being monitored to some

extent. Analysis however is conducted outside the country, for all pesticides residues on a project-by-project basis. No routine analysis is carried out in the country. Buyers of export produce abroad, request for samples from exporters for pesticides residue analysis. Also, when field trials are conducted, samples are sent abroad for analysis.

2.4.10.4 Capacity and Infrastructure for Monitoring Effects of POPs on Human Health

One of the conclusions of the inventory conducted by the health task team indicated that currently there are no specific programmes for monitoring the effects of POPs on human health. The survey identified among other things, inadequate personnel and facilities required to effectively monitor the effects and assess the impact of POPs on the population. There is therefore the need to train health personnel in particular and other related institutions and equip existing laboratories to carry out proper assessment of POPs on human health on a continuous basis.

2.4.10.5 Capacity and Infrastructure for Research and Development

A situational analysis was conducted on the monitoring, research and development capacity of the various institutions in the fields of:

- Environmental chemistry and fate of POPs
- Socio-economic and cultural impacts of POPs
- Effects of POPs and measurements on human health and the environment.

It became clear from the country analysis that the chemical effects of POPs on economic, social and health activities are quite well known. However it is difficult to assess the institutional capacity to deal with the problems that may arise in terms of monitoring, research and development of its human and material resources. The following academic and research institutions in Ghana have the potential to develop and to meet the challenges identified:

- Environmental Protection Agency
- Ghana Standards Board
- University of Ghana
- University of Cape Coast
- University of Development Studies
- Kwame Nkrumah University of Science and Technology
- Ministry of Trade and Industry
- Ghana Atomic Energy Commission
- Noguchi Memorial Institute on Medical Research
- Council for Scientific and Industrial Research
- Food and Drugs Board
- Electricity Company of Ghana
- Customs, Excise and Preventive Service
- Volta River Authority

The above institutions have similar and basic problems including inadequate facilities, personnel and infrastructure required for effective research and development. There is therefore the need to resource the institutions to enable them undertake local research and development and also contribute to the ongoing Global Monitoring Programme on POPs towards the effectiveness evaluation as required under Article 16 of the Convention.

2.4.10.6 Capacity and Infrastructure for Information Management

The EPA has initiated the process of developing a comprehensive chemicals information management system to assist in sound chemicals management including POPs. The information system would be

networked with relevant public and private institutions to facilitate the exchange of information on chemicals and to make the systems easily accessible to the general public. This system will serve as the national focal point for the exchange of information and a clearinghouse mechanism for information on POPs as required under Article 9 of the Convention.

Effective implementation of the NIP would provide inputs to the chemicals information system. This would require the development of expertise among relevant stakeholders to improve the management of POPs.

2.4.10.7 Institutional Capacity Gaps

The gaps identified are in terms of human and institutional capacity. All the institutions involved with POPs regulation or management do have experts with the necessary qualifications. These experts are however not many. As a result, there is heavy work pressure. In the Ministry of Health for example, there are only two officers who have training in related fields.

The remuneration and motivation in most state institutions are so low that, experts in the relevant fields are often enticed by foreign and private organisations to leave the government sector. In the Universities, the chemistry and other departments are often under staffed.

The lack of personnel is exacerbated by the absence of other resources like equipment to carry out experiments and monitor activities related to POPs. For instance, the GSB, an institution responsible for metrology, standardisation, testing and quality assurance does not have adequate reference analytical standards and equipment for their activities in the area of POPs. The laboratory requires accreditation as a reference laboratory. The FDB, an institution in charge of regulating the manufacture, importation, sale and use of foods, drugs, household chemicals and medical devices is also understaffed.

The FDB has powers analogous to those of the EPA, albeit the former's mandate is limited to regulating, monitoring and enforcing activities related to foods and consumable drugs. It however does not deal with POPs directly. The FDB has the limitations of human resources and laboratory equipment to carry out the necessary tests for POPs. There are overlaps in the functions of the two institutions (EPA and FDB) where pesticides are concerned.

The NMIMR, a research institute for health and educational purposes, could be helpful in research into the effects of POPs on soil and water resources but requires reagents and enzyme consulates of the various POPs for their determination by the ELISA method.

Ghana Atomic Energy Commission has been dealing with Aldrin for the past fifteen years. The Commission however requires financial support and institutional capacity to research and deal with POPs activities.

CSIR conducts research, monitors and evaluates the contamination of soil, plants and water resources. The institution has done some research on chemical residues in food and water. Though this is not limited to POPs specifically, they are capable of doing similar research on POPs. However the chemicals for such analysis are expensive and the individual cannot pay for such services.

It was generally suggested that, efforts should be made to enforce Act 528 because most of the POPs contamination in Ghana, are possibly through pesticides.

The ECG used to import transformers containing PCBs. Most of these plants are out of use but have not been properly stored or disposed of. They therefore contaminate groundwater and affect animal life. They also lack the resources to deal with storage and destruction of PCBs. Their activities need professional support and monitoring to ensure compliance where pesticides and chemicals are concerned.

The EPA and other relevant institutions, lack the human and financial resources as well as logistics to deal with POPs.

2.4.11 Identification of Impacted Populations or Environments, Estimated Scale and Magnitude of Threats to Public Health and Environmental Quality and Social Implications for Workers and Local Communities

2.4.11.1 Preliminary Assessment of the Extent of Exposure of the Human Population and the Environment, especially Vulnerable Groups to POPs

A review of the extent of exposure of the human population and environment in Ghana to POPs was carried out. The inventory covered the extent to which POPs is an issue in Ghana with regard to production, use, emission, to assess human exposure particularly that of vulnerable groups.

A number of reviews, evaluations and assessments of POPs sources, regulations on its use, situational analysis in Ghana of POPs in terms of its lifecycle; its presence in the environment, food, feed and humans; national monitoring capacity and vulnerable groups at risk and those with a potential risk of exposure to POPs; environmentally sensitive areas to POPs emissions, hot spots and contaminated sites have been documented..

(a) Presence of POPs in the Environment, Food, Feed and Humans

No institution or organization has been mandated to monitor POPs in the environment, food, feed and humans, though some organizations may deal with some aspect of this, especially in analysis, in the course of their work. No institution monitors the presence of POPs Pesticides, industrial POPs, dioxins and furans.

(b) Potential Risk Groups

Potential risk groups are those who may be exposed occupationally and non-occupationally. Occupationally, the risk group include,

- Workers from the small scale aluminium smelting companies who rely on scrap metals as raw materials for production.
- Casual workers employed to work at waste dump sites.
- Casual workers involved in asphalt mixing during road construction.
- Personnel at the petroleum refinery exposed to leaded fuel and also at the fuel dispensers.
- Fish smokers employing polished timber as fuel wood
- Farmers engaged in agricultural production where the use of pesticides is not regulated.

The non-occupational group includes the general public exposed to emissions from open burning of waste, domestic and industrial fires, bush burning and vehicular emissions.

It is estimated that, from these and many other potential risk groups, over half of the population of Ghana may be directly or indirectly exposed to POPs, aggravating the threat of health related issues and decline in environmental quality. These have both social and health implications for workers and local communities.

Exposures in both cases are either accidental or deliberate. However, these could be prevented to a large extent by the institution of safe systems of work and the use of appropriate personal protective equipment.

(c) Preventive and Promotive Measures for POPs

The use of personal protection equipment is very limited among agricultural workers. This may either be due to lack of knowledge on its significance or sheer recalcitrance. The same can be said for transportation, storage and disposal of chemicals and their containers after use. Medical surveillance among POPs users needs to be researched into. Employers should be sensitized to provide routine medical examinations for their employees. In areas of dioxin and furan releases, vulnerable groups are

taking no special precautions. There is therefore an urgent need for sensitization at both the individual and institutional levels if preventive measures are to be effective.

(d) Gaps and Priority Areas

The gaps identified can be bridged by putting in place measures to increase public education and raise awareness. Encouragement of research in grey areas, training of specialists, conducting of studies on health effects of those exposed and the general public. Priority areas that need urgent attention include the following:

- Training of specialists in clinical toxicology to strengthen the management of poisoning cases in the health institutions and poison centers;
- A well-equipped national accredited laboratory, which can analyze and detect samples to the minutest detail possible.

2.4.12 Details of any Relevant System on Assessment and Listing of New Chemicals

There are existing procedures for the assessment of new pesticides to be registered in Ghana. This is in accordance with the Pesticides Control and Management Act, 1996 (Act 528) and details of these procedures are indicated in section 2.2.5.2.

2.4.13 Details of Any Relevant System on Assessment and Regulation of Chemicals Already in the Local Market

Provisions are made for the assessment and regulation of pesticides already in the market. This is in accordance with the Pesticides Control and Management Act, 1996 (Act 528) and details of these procedures are presented in section 2.2.5.2.

CHAPTER 3: STRATEGY AND ACTION PLAN ELEMENTS OF THE NATIONAL IMPLEMENTATION PLAN

3.0 Introduction

This chapter comprises a formal policy statement and the implementation strategy for the NIP. The implementation strategy sets out specific action plans or strategies to achieve obligations of the Stockholm Convention and any additional objectives.

3.1 Policy Statement

Ghana participated in the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in 1992. At this Conference, 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 particular relevance for chemicals management is Chapter 19 of “Agenda 21” which deals with environmentally sound management of chemicals, including illegal international traffic in toxic and dangerous products. Under this, governments are expected to develop actions and priorities relating to:

- Information exchange on toxic chemicals and chemicals risks;
- Harmonisation of classification and labelling of chemicals;
- Expanding and accelerating international assessment of chemical risks;
- Establishment of risk reduction programmes;
- Prevention of illegal international traffic in toxic and dangerous products;
- Strengthening national capabilities and capacities for the management of chemicals.

In response to this global concern, the Government of Ghana has taken concrete steps and measures to achieve sustainable environmental protection and economic development. The ultimate aim of Ghana’s overall national environment policy is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. It seeks to ensure reconciliation between economic development and natural resource conservation, making a high quality environment a key element supporting Ghana’s economic and social development. The policy, specifically, seeks to:

- Maintain the ecosystems and ecological processes essential for the functioning of the biosphere;
- Ensure sound management of natural resources and the environment;
- Adequately protect humans, animals and plants, their biological communities and habitats against harmful impacts and destructive practices, and preserve biological diversity;
- Guide development in accordance with quality requirements to prevent, reduce, and as far as possible, eliminate pollution and nuisances;
- Integrate environmental considerations in sectoral, structural and socio-economic planning at the national, regional, district and grass roots levels; and
- Seek common solutions to environmental problems in West Africa, Africa and the world at large.

3.1.1 Government’s Commitment to Address the POPs Issue

Within the context of chapter 19 of Agenda 21 and in line with the Ghana Environmental Action Plan, the Government of Ghana’s policy on the environment 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”.

Persistent Organic Pollutants (POPs) fall under the category of potentially toxic chemicals. Ghana is committed to the effective implementation of the provisions and obligations of the Stockholm Convention on POPs. This is clearly demonstrated through the early adoption and ratification of the Convention by the Government of Ghana. The Environmental Protection Agency is expected to play a lead role in promoting safe management and use of chemicals (including POPs) for industrial, agricultural, public health and consumer uses in order to avoid damage to human health, the ecosystems, and the environment in general in ensuring sustainable development.

As a first step to ensure sound management of chemicals in Ghana, a national profile for chemicals management was prepared in 1997. The document provides a comprehensive assessment of the national chemicals management infrastructure relating to the legal, institutional, administrative and technical aspects, along with an understanding of the nature and extent of chemicals availability and use. The profile has been updated to take on the particular issues on POPs. A national action programme for an integrated chemicals management programme in Ghana was also initiated in 1997.

The overall objective of the sound management of POPs in Ghana is firstly to strengthen the national capacity and capability to deliver a comprehensive assessment of the threats posed by exposure of POPs to humans and the environment. Appropriate actions, activities and strategies will then be implemented to reduce and ultimately eliminate POPs from the environment as envisaged under the Stockholm Convention on POPs. The Ghana National Implementation Plan will build on existing work and assessments and form an integral part of the national integrated chemicals management programme. It will take due account of the aims of the national sustainable development in the sense of social, economic and environmental policies and actions in order to maximize their overall benefits. This will avoid “reinventing the wheel” and link the NIP to related national chemicals management initiatives where possible to ensure maximum efficiency and reduce duplication of effort.

3.1.2 Endorsement of NIP

The process of the development of the NIP involved the active participation of broad-base relevant national stakeholders, including government ministries, departments and agencies; research institutions and academia; non-governmental organizations (including women and children activists), community based organizations; and the media. The NIP has been commented upon and endorsed by the national stakeholders (see Annex VI – List of National Stakeholders).

3.2 Implementation Strategy

An effective implementation of the Stockholm Convention on POPs hinges on a well-fashioned strategy. The essential elements of such an implementation strategy are outlined below.

3.2.1 Implementation Principles

The implementation strategy is based on the following principles:

3.2.1.1 Public and Stakeholder Participation

A coordinated approach will be adopted, with co-operation among all relevant stakeholders at all levels and all sectors. Responsibilities related to chemicals management as well as those involved in activities that influence chemical safety, including the private sector, industry, labour and public interest groups will be assigned. Women and children’s groups in particular, will be empowered and encouraged to actively participate in the implementation of the NIP.

3.2.1.2 Transparency in Information Sharing and Exchange

Data/Information will be collected and where necessary generated, especially those specific to the national or local situation and made available to the general public. National chemical databases will provide information on the amounts of chemicals imported, formulated and traded in the past and present. Clinical, epidemiological, and environmental data are needed to support decision-making as well as assess and manage risks under local conditions.

3.2.1.3 Adherence to Polluter Pays Principle

Adequate legal, institutional, administrative and technical infrastructure will be pursued. This will help enforce regulatory provisions of the Convention including adherence to “the polluter pays principle”.

3.2.1.4 Integration with Overall Environmental Management and Sustainable Development Policies

Implementation of the NIP is expected to contribute to the promotion of sound management of chemicals (including POPs) for industrial, agricultural, public health and consumer purposes in order to avoid damage to human health, the ecosystems, and the environment in general. This will ensure the attainment of sustainable development goals contained in the Ghana Environmental Action Plan.

3.2.1.5 Adherence to and Use of Technologies and Applications of International Standards

The risk of POPs to human health and the environment will be assessed using internationally recognised criteria, standards and limits to the extent possible. Risk management based on sound principles and use of Best Available Techniques and Best Environmental Practices (BAT/BEP) will be applied.

3.2.1.6 Commitments Regarding Public Awareness and Education

Efforts will be made to train and sensitise identified groups and the general public on POPs issues. An informed and aware population is recognised as vital in achieving public co-operation and confidence in POPs management.

3.2.1.7 Adherence to International Requirements

Decisions concerning manufacture, formulation, import and use of individual and candidate POPs will be reassessed, periodically on a scheduled basis and in response to the availability of significant new information so as to meet international requirement including those of the EU. Research into alternative chemicals to POPs will be vigorously pursued.

3.2.2 Priorities and Conditionality

The main priority areas of national concern have been identified as follows:

- xi. Public education and awareness creation;
- xii. Monitoring, control and evaluation;
- xiii. Development of new legislation, harmonizing of existing legislation;
- xiv. Detailed inventory of POP chemicals and identification of hot spots including contaminated sites;
- xv. Capacity building towards the elimination of Polychlorinated Biphenyls in Ghana;
- xvi. Capacity building towards the implementation of BAT and BEP guidelines for source reduction of POP emissions
- xvii. Strengthening the institutional capacity in terms of legal, technical infrastructure and human resource (e.g. training of Customs Officers and Environmental Inspectors etc) to manage POPs;
- xviii. Information Exchange and Networking;
- xix. Identification and management of contaminated sites including remediation, and
- xx. Research into the extent of exposure of the population to POPs and the search for safer alternatives.

The implementation of the above priorities will require expertise in various areas including the following:

- i. Information and Communication Technology
- ii. Monitoring and Evaluation
- iii. Planning and Policy Analysis
- iv. Risk Assessment and Risk Management
- v. Toxicology and Ecotoxicology
- vi. Hazardous Waste Management
- vii. Municipal Waste Management
- viii. Remediation of Contaminated Sites
- ix. Chemical Engineering
- x. Analytical Chemistry
- xi. Gender Analysis
- xii. Social Science
- xiii. Occupational Health and Safety
- xiv. Poison Control and Management
- xv. Law
- xvi. Environmental Science
- xvii. Industrial Management
- xviii. Chemicals Control and Management
- xix. Research
- xx. Environmental Economics

The Government of Ghana is expected to contribute resources towards the effective implementation of the NIP. In addition project proposals will be developed and submitted to bilateral, multilateral and private agencies for assistance to implement some of the planned activities. This is expected to augment the financial arrangements and technical assistance programmes established under the Convention (Articles 12, 13 and 14).

3.2.3 MAJOR MILESTONES

Specific milestones have been set within each of the action plans with mechanisms for reporting progress at stipulated periods. Assuming optimal conditions in terms of institutional and financial arrangements for implementation of the NIP, the major milestone would be the year 2005 for the phasing out of PCBs.

3.2.4 Institutional/Organisational Arrangements and Assignment of Responsibilities

The outline framework mechanism for the above strategy is presented in Table 8.

3.2.5 Implementation Approach

The implementation approach is outlined in the action plan and strategies, which indicate the implementation of certain specific activities. It includes budget lines, timeframes, performance indicators, resource requirements and obligations of stakeholder institutions in the execution of activities specified in the plan.

Table 8: Responsibility Assignment Matrix

Roles	Responsible Institutions/Organizations
National intersectoral coordination;	MLGRD&E, EPA, CEPS, CSIR, MoH/GHS, MoFA, GSB, FID, GNAFF, ECG, Universities, AGI, GTPCW-TUC, GAEC
Regulatory and enforcement	EPA, TCPD, Mines Dept., Minerals Commission, CEPS, MoH/GHS, FDB, VSD/MoFA, PPRSD/MoFA, GSB, GAEC, Energy Commission, GPHA, WRC, FID, AG's Dept., Judiciary, GPS, CSD/COCOBOD, Pharmacy Council, Ghana Armed Forces
Monitoring and Research	EPA, TCPD, Mines Dept., Minerals Commission, ECG, GWCL, CEPS, MoH/GHS, FDB, VSD/MoFA, PPRSD/MoFA, GSB, GAEC, Energy Commission, GNPC, GPHA, Regional Maritime Academy, WRC, FID, AG's Dept., Judiciary, GPS, CSD/COCOBOD, IDA, Pharmacy Council, Universities, Ghana Armed Forces, CRIG,
Policy	MLGRD&E, MoLF, MoFEP, MoES, MoH, MoFA, MoTI&PSI, MoESc&S, MoRT, MoPHR, MoWRWH, MoJ/AG's Dept., WoWCA, MoInf, MoD,
Risk communication, education and public awareness	MLGRD&E; EPA; CSIR, TCPD MoLF, Mines Department; MC, MoFEP, CEPS, MoESc&S, MoH/GHS, FDB, GTPCW-TUC, MoFA; PPRSD/MOFA, MoFA/VSD, MoTI&PSI, GSB, Energy Commission, GAEC, GNPC, MoRT, MoPH&R; GPHA, RMA; MoWW&H, WRC, FID, Ag's Dept., GPS, IDAG, COCOBOD, MoWCA, MoI, MoD, GAF, GNAFF, CRIG, AGI, ECG, GWCL, VRA, Universities (UG, KNUST, UCC, UDS); Environmental NGOs
Review, reporting, evaluation and updating of the NIP	Ministry of Local Government, Rural Development and Environment; Environmental Protection Agency

3.2.6 REVIEW MECHANISMS FOR IMPLEMENTATION STRATEGY

A hierarchy of implementation arrangements would be established comprising the NCT as the overall supervisory body; National Programme Director and the NIP Secretariat.

The National Programme Director will be responsible for the overall coordination of the NIP implementation and ensure that periodic reports are submitted to the Convention Secretariat in line with the reporting mechanisms established under Article 15. The Programme Director would also appoint external monitoring and evaluation experts to monitor progress of NIP implementation based on agreed performance indicators and where necessary recommend any adjustments to the NIP.

Officers of the secretariat would be designated as project managers for the execution of the various sub-projects during the implementation phase and would be required to supervise specific activities assigned to stakeholder agencies and report to the National Programme Director.

3.3 Activities, Strategies and Action Plans

The following strategies, activities and actions have been outlined with the view to accelerate the national efforts towards the fulfilment of the country's obligations under the Stockholm Convention.

3.3.1 Activity: Institutional and Regulatory Strengthening Measures

In Ghana, the issue of chemicals including Persistent Organic Pollutants is of great concern. However, there is no comprehensive legislation for chemicals management in the country although some aspects are found in various laws within the country. The Stockholm Convention on POPs mandates Parties to take certain measures to achieve the objective of the Convention. A successful implementation of the Convention in Ghana would therefore involve the integration of some of these provisions into the current institutional and regulatory framework for managing chemicals in the country.

The objective is to prevent the production and use of new pesticides and industrial chemicals that are deemed to be candidates of POPs. This action Plan therefore aims at strengthening the existing institutional and regulatory framework in Ghana.

3.3.2 Activity: Measures to Reduce or Eliminate Releases from Intentional Production and Use

In Ghana there is no intentional production of POPs chemicals. Except for PCBs, which are still used in electrical equipment, there is no legal intentional use of POPs chemicals. However, it appears that certain POPs pesticides as well as PCBs may be used illegally. This is either from existing stockpiles or from illegal importation. It is therefore necessary to identify measures to ban and prohibit the illegal importation and use of POPs pesticides and the illegal use of PCBs. Article 3 of the Convention summarizes activities that must be put in-place to reduce and eliminate releases from intentional production. These activities include legal and administrative measures. This action plan presented below identifies measures to reduce or eliminate releases from intentional production and use of POPs.

3.3.3 Activity: Production, Import and Export, Use, Stockpiles and Wastes of Annex A POPs Pesticides (Annex A, Part I Chemicals)

Preliminary inventory of Annex A, Part I chemicals in Ghana gave no reliable records on production, import, export, and use of POPs pesticides in Ghana. Though some evidence exists that there has been an unofficial importation and use of HCB in recent times the source, destination and quantities could not however be ascertained due to lack of proper monitoring to track down illegal importations into the country. Unspecified quantities of stockpiles and waste of Annex A, Part I Chemicals and their locations have not been reliably established. Analytical investigation of organochlorine pesticide poisons of organs of human body and fluids have been conducted by the Forensic Science Laboratory of the Ghana Standards Board in collaboration with the Department of Pathology at the University of Ghana Medical School. This and other reported incidents suggest that some of the organochlorine pesticides are still in use illegally and might include Annex A Part I Chemicals. Residues of POPs pesticides (Annex A Part I Chemicals) as a result of intensive past application may still be present in the environment. The following action plan details activities to be undertaken in respect of the production, import and export, use, stockpiles and waste of Annex A Part I chemicals.

3.3.4 Activity: Production, Import and Export, Use, Identification, Labelling, Removal, Storage and Disposal of PCBs and Equipment Containing PCBs (Annex A, Part II chemicals)

There is no and has never been any production of PCBs in Ghana. Preliminary inventory revealed that there are about 455 pre-1972 possible PCB- containing transformers countrywide and 147 pieces of 11kV and 33kV possible PCB-containing capacitors with thirty-one (31) out of these capacitors decommissioned and discarded. However, importation and use of closed, semi-closed and open application equipment in the country are not properly monitored and documented.

The proposed activities define specific actions in respect of managing PCBs, both in the short and the long term in a manner that is consistent with the obligations of the Stockholm Convention. The overall objective is a reduction and ultimate elimination of PCBs use, the prevention of releases of the chemical into the environment, and to provide for environmentally sound disposal or final elimination of PCBs waste.

3.3.5 Activity: Production, Import and Export, Use, Stockpiles and Wastes of DDT (Annex B Chemicals) if used in country. (See also 3.3.2 and 3.3.1 Activity 4)

DDT was used extensively in Ghana in the past both for agriculture and public health purposes. The chemical has been banned since 1985. There is however general paucity of data on DDT import and application in Ghana. There is no information on export of any kind. A limited record and estimates have

been made to show the extent of use of DDT in Ghana. The table below shows activities the country intends to adopt in the management of DDT in Ghana.

3.3.6 Activity: Register for Specific Exemptions and continuing need for Exemptions (Article 4)

Article 4 of the Stockholm Convention on POPs requires the establishment of POPs register for the purpose of identifying parties that have specific exemptions listed in Annex A or B. All registrations of specific exemptions are subject to periodic review. Ghana has not applied for any exemption under the Stockholm Convention and does not anticipate the need for any exemption in the future. However in the event of a need for an exemption, the activities listed in the table below will be undertaken to meet the obligations under Article 4.

3.3.7 Activity: Measures to Reduce Releases from Unintentional Production (Article 5)

There are so far no reported adverse health effects that have been linked with background exposures from unintentional release of PCDD/PCDF, HCB and PCBs. This is not to suggest that none of such effects exist. There is probably already a large burden of PCDD/PCDF, HCB and PCBs in our environment, undetected and which will persist for many years. Lack of technical expertise and resources limits the country's ability to identify and estimate the actual health and environmental impacts from PCDD/PCDF, HCB and PCBs. Ghana needs to take all necessary actions to safeguard the quality of its food, water, land and air in order to protect the health of its people and avoid any potential for damage to the economy. Aggressive measures must be implemented if the exposure of the human population is to be significantly decreased. This proposal therefore is an action plan for reducing the unintentional releases from chemicals in article 5 of the Stockholm Convention.

3.3.8 Activity: Measures to Reduce Releases from Stockpiles and Wastes (Article 6)

Toxic releases from stockpiles and waste constitute serious threat to human health and the environment. This calls for their safe, efficient and environmentally sound management. Activities geared towards the development of appropriate strategies and measures to stem releases through actions such as proper handling, collection and transport and disposal of such stockpiles and waste are outlined below.

3.3.9 Strategy: Identification of Stockpiles, Articles in Use and Wastes

Information obtained from preliminary inventory of POPs stockpiles, articles in use and waste was insufficient to make any meaningful conclusions. For an accurate assessment of these stockpiles, waste and articles in use to be done, it is necessary for these products to be properly identified and characterized. This strategy proposes steps that have to be taken to achieve the intended objective

3.3.10 Activity: Measures to Manage Stockpiles and Appropriate Measures for Handling and Disposal of Articles in Use

Safe, efficient and environmentally sound management of stockpiles as well as proper handling and disposal of articles in use, which contain POPs, are paramount for the achievement of the country obligations under the Stockholm Convention (Article 6). Appropriate measures are required in order to achieve such goals.

3.3.11 Strategy: Identification of Contaminated Sites (Annex A, B and C Chemicals) and Remediation in an Environmentally Sound Manner

Article 6 of the Stockholm Convention requires that Parties develop appropriate strategies for the identification of sites contaminated with chemicals listed in Annex A, B or C and remediation of such sites carried out in an environmentally sound manner. The country strategy is as outlined below:

3.3.12 Activity: Public Awareness, Information and Education (Article 10)

The successful implementation of the Stockholm Convention on POPs in Ghana will only be achieved when the general population is sensitised on the nature of POPs and their effects on human health and the environment and get committed to the achievement of the objective. It is therefore important for action to be directed at promoting the continuous and detailed public awareness, information and training programmes on POPs. Such programmes will be targeted at the policy and decision makers as well as the general public. Various stakeholders in the POPs management will be trained and equipped to play their respective roles. The following activities will be pursued in the attainment of the said objectives.

3.3.13 Activity: Effectiveness Evaluation (Article 16)

Article 16 of the Convention requires parties to establish mechanisms for providing comparable monitoring data on the presence of Annex A, B and C chemicals. This evaluation shall be conducted on the basis of available scientific, environmental, technical and economic information including national reports. The activities below provide details of actions to achieve the provisions of the Convention.

3.3.14 Activity: Reporting

Article 15 of the Stockholm Convention on POPs mandates parties to report to the Conference of Parties (COP) on measures taken to implement the provisions of the Convention as well as the effectiveness of the measures taken. In addition, each party is to provide to the Secretariat, statistical data on its total quantities of production, import and export of each of the chemicals listed in Annex A and B as well as a list of states from/to which it has imported/exported each of such substances. These reports will provide a substantial input to the effectiveness evaluation of the Convention (Article 16), which will commence four years after the entry into force of the Convention. This Action Plan therefore aims at collecting/collating all information relevant to the provisions of the Convention and packaging them in a suitable manner for reporting to the secretariat and the COP.

3.3.15 Activity: Research, Development and Monitoring (Article 11)

Article 11 of the Stockholm Convention mandates parties to undertake appropriate research, development, monitoring and cooperation pertaining to POPs and where relevant to their alternatives and candidate POPs. From initial assessment conducted, it was established that the country lacks the requisite infrastructure and institutional capacities to handle research and development issues relating to POPs. This section therefore identifies various activities in addressing the research, development and monitoring needs of Ghana.

3.3.16 Activity: Technical and Financial Assistance (Articles 12 and 13)

The ability of Ghana to fulfill its obligations under the POPs Convention depends on the provision of adequate financial and technical assistance. The following actions would be required to enable the country obtain the needed financial and technical support required for the successful implementation of activities and actions to be carried out to achieve the POPs overall objectives.

3.4 Development and Capacity Building Proposals and Priorities

This section presents initial five (5) project proposals to operationalise the National Implementation Plan. The overall goal of the projects is to improve the management of risks to human health and the environment from Persistent Organic Pollutants. The specific projects and their respective objectives are summarized below. The main proposals and priorities are contained in Annex VII.

3.5 Timetable for Plan Implementation and Measures of Success

The following table provides a summary of activities, strategies and action plans outlined in section 3.3. Specific targets, milestones and performance indicators are outlined to allow progress of implementation to be reviewed and monitored.

Table 9: Timetable for Plan Implementation and Measure of Success

No	Principal and Specific Targets	PROJECT DURATION (YEARS)																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
1.	Institutional and regulatory strengthening measures																											
2.	Measures to Reduce or Eliminate Releases from Intentional Production and Use																											
3.	Production, Import and Export, Use, Stockpiles and Wastes of Annex A POPs Pesticides (Annex A, Part I Chemicals)																											
4.	Production, Import and Export, Use, Identification, Labelling, Removal, Storage and Disposal of PCBs and Equipment Containing PCBs (Annex A, Part II chemicals)																											
5.	Production, Import and Export, Use, Stockpiles and Wastes of DDT (Annex B Chemicals) if used in country																											
6.	Register for Specific Exemptions and the Continuing need for Exemptions																											
7.	Measures to Reduce Releases from Unintentional Production																											
8.	Measures to Reduce Releases from Stockpiles and Wastes																											
9.	Identification of Stockpiles, Articles in Use and Wastes																											
10.	Measures to Manage Stockpiles and Appropriate Measures for Handling and Disposal of Articles in Use																											
11.	Strategy: Identification of Contaminated Sites (Annex A, B and C Chemicals) and Remediation in an Environmentally Sound Manner																											
12.	Facilitating or undertaking Information Exchange and Stakeholder Involvement																											
13.	Activity: Public awareness, information and Education																											
14.	Effectiveness Evaluation																											
15.	Reporting																											
16.	Research, Development and Monitoring																											
17.	Technical and Financial Assistance																											

3.6 Resource Requirements

A summary of resources required for the successful and effective implementation of the identified tasks and activities are provided below in a resource requirements matrix.

Table 10: Resources Required for the Successful and Effective Implementation of the Identified Tasks and Activities

No	Principal and Specific Targets	Human Resources	Facilities	Equipment	Materials	Special resources	Total Resource Cost (USD)
1	Institutional and regulatory strengthening measures	Local and national experts (fees travels, per diem)	Rental of conference / workshop facilities		Communication, presentations and handout, printing		120,000
2	Measures to Reduce or Eliminate Releases from Intentional Production and Use	Local and national experts (fees travels, per diem)	Rental of Conference /workshop facilities	2 laptop computers	Communication Presentations and handouts, Printing		700,000
3	Production, Import and Export, Use, Stockpiles and Wastes of Annex A POPs Pesticides (Annex A, Part I Chemicals)	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities	Data storage	Communication, presentations and handout, printing		Included in 2 above
4	Production, Import and Export, Use, Identification, Labelling, Removal, Storage and Disposal of PCBs and Equipment Containing PCBs (Annex A, Part II chemicals)	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities		Communication, presentations and handout, printing		7,000,000
5	Production, Import and Export, Use, Stockpiles and Wastes of DDT (Annex B Chemicals) if used in country	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities	Data storage	Communication, presentations and handout, printing		Included in 2 above
6	Register for Specific Exemptions and the Continuing need for Exemptions	Local and national experts (fees travels, per diem)	Rental of conference/workshop facilities		Communication, presentations and handout, printing		Included in 12 below
7	Measures to Reduce Releases from Unintentional Production	Local and national experts (fees travels, per diem). Analytical skill	Rental of Conference /workshop facilities, lab facilities and chemicals	2 laptop computers	Communication Presentations and handouts Printing		2,500,000
8	Measures to reduce releases from stockpiles and waste	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities		Communication, presentations and handout, printing		Included in 7 above

Table 10: Resources required for the successful and effective implementation of the identified tasks and activities (Continued)

No	Principal and Specific Targets	Human Resources	Facilities	Equipment	Materials	Special resources	Total Resource Cost (USD)
9	Identification of stockpiles, articles in use and waste	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities		Communication, presentations and handout, printing		Included in 7 above
10	Measures to manage stockpiles and appropriate measures for handling and disposal of articles in use	Local and international experts (fees travels, per diem)	Rental of conference/workshop facilities		Communication, presentations and handout, printing		Included in 7 above
11	Identification of contaminated sites (Annex A, B and C chemicals) and remediation in an environmentally sound manner.	Local and international experts (fees travels, per diem). Analytical skills	Rental of Conference /workshop facilities, lab facilities and chemicals		Communication, Presentations and handouts, Printing		2,000,000
12	Facilitating or undertaking information exchange and stakeholder involvement	Two (2) full time professional staff and two (2) auxiliary staff. International and local consultant	Office space and furniture 2 vehicles	Two (2) Computers with accessories. Internet connectivity communication equipment (telephone, fax etc)	Training materials,		500,000
13	Public awareness, information and Education	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities 2vehicles		Communication, Presentations and handouts. Printing Training materials	Payment for broadcast	2,500,000
14	Effectiveness Evaluation	Local and international experts (Fees, travels and per diem)	Rental of Conference / workshop facilities		Communication, presentations and handout, printing		Included in 12 above
15	Reporting	Local and international experts (Fees, travels and per diem)	Rental of Conference / workshop facilities	2 Laptop computers	Communication Presentations and handouts, Printing		Included in 12 above
16	Research, development and monitoring	Local and international experts (Fees, travels and per diem), analytical skills. Installation and electrical skill	Rental of Conference /workshop facilities, lab space		Communication, presentations and handout, printing, standard electrical supplies		8,875,000
17	Technical and financial assistance)	Local and international experts (Fees, travels and per diem)	Rental of Conference /workshop facilities		Communication, presentations and handout, printing		Included in 12 above

Table 11: Institutional and Regulatory Strengthening Measures

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resources / Needs
(1) To harmonize existing legal/policy framework on chemicals including POPs in Ghana	<ul style="list-style-type: none"> Update and compile inventory of existing legal instruments that address the management of chemicals including POPs. Review relevant existing legislations in the management of POPs to assess need for modification and strengthening. Draft and promulgate regulations to prohibit/eliminate the production, use, importation and exportation of chemicals listed in Annexes A, B and C of the Convention. Codify all legislations related to chemicals and develop a chemicals management law. 	<p>Compiled and updated inventory. Proposals for legislative and policy review.</p> <p>Draft regulation.</p> <p>A draft chemicals code.</p>	5 years	EPA, CEPS Parliament, Attorney General's, Department Research Institutions	Finance, Logistics, Resource Personnel, Capacity Building, Training.
(2) To identify needs of relevant regulatory institutions to manage POPs	<ul style="list-style-type: none"> Design and pilot test survey questionnaire. Administer and analyse questionnaire Prioritise needs of institutions Determine costs for upgrading Physical capacities 	<p>Needs assessment conducted</p> <p>Modalities for upgrading physical capacities in place</p>	4 months	EPA, Relevant Stakeholders	Finance, Resource Personnel
(3) To sensitize relevant institutions on compliance and enforcement of regulations on POPs	<ul style="list-style-type: none"> Organize sensitisation workshop 	Workshop organised	1 month	EPA, Relevant Stakeholders	Finance, Logistics, Resource Personnel

Table 11: Institutional and Regulatory Strengthening Measures (Continued)

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resources / Needs
(4) To assist relevant institutions implement compliance and enforcement strategies on POPs. (i) POPs Pesticides (ii) PCBs wastes disposal (iii) Dioxins/Furans inventory etc	<ul style="list-style-type: none"> Prepare Memorandum of Understanding (MOUs) with relevant institutions and assign them with specific responsibilities towards the implementation of the Convention. Form a Compliance and Enforcement Network. Build capacity of personnel from all relevant institutions. e.g. recruitment and training of staff. Develop monitoring plan of activities for relevant institutions. 	MOU in place Compliance and enforcement network operational. Well equipped institutions Operational monitoring plans	2 years	EPA, Relevant Stakeholders AG, Police, CEPS	Finance, Legal Experts

Table 12: Measures to Reduce or Eliminate Releases from Intentional Production and Use

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(1) To reduce/eliminate releases from intentional production and use of POPs.	<p>(a) Inventory of annex A and B chemicals imported and used in Ghana.</p> <p>(b) Analyse pattern of usage of annex A and B chemicals</p> <p>(c.) Dispose off obsolete annex A and B chemicals in an environmentally sound manner</p>	Database of Annex A & B Chemicals Use pattern of Annex A & B chemicals identified Report on Disposal	5 years	EPA, Relevant Stakeholders	Financial assistance, Technical assistance / expertise
(2) To ban/prohibit import of Annex A & B chemicals (See section 3.3.1, activity 1)	(a) Develop regulatory framework	Prohibition regulation	1 year	EPA, Relevant Stakeholders Attorney Generals Dept., Parliament	Financial assistance, technical assistance / expertise, consultants

Table 13: Production, Import and Export, Use, Stockpiles and Wastes of Annex POPs Pesticides (Annex A, Part I Chemicals)

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(1) To update inventory of Production, Import and Export, Use, Stockpiles and Wastes of Annex A part I chemicals (see 3.3.2, activity 1)	Carry out further inventory into the illegally Imported, and Use, Stockpiles and Wastes of Annex A part I chemicals	Inventory report	12 months	EPA, Relevant Stakeholders	Financial assistance, Personal protective equipment, Technical assistance / expertise
(2) Develop data management system for the Annex A part I chemicals	Archiving and data management system	Data base established	12 months	EPA, Relevant Stakeholders, CEPS,	Computer equipment, Computer hard ware and software, computer accessories and Training

Table 14: Production, Import and Export, Use, Identification, Labelling, Removal, Storage and Disposal of PCBs and Equipment Containing PCBs (Annex A, Part II chemicals)

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(1) To carry out detailed inventory on PCBs and equipment containing PCBs (Annex A, Part II Chemicals)	<ul style="list-style-type: none"> Identify additional source categories for PCB to include unclassified closed transformers and capacitors and especially partially closed and open applications. Identify PCBs and PCB-containing equipment Prepare an inventory of PCBs and PCB containing equipment. Identify PCB-contaminated sites. 	Inventory of PCBs and PCB containing equipment updated Contaminated sites mapped out	8 months	EPA, Relevant Stakeholders	Financial Assistance, Vehicles
(2) To analyse PCBs in transformers and capacitors and other partially closed and open applications in Ghana.	<ul style="list-style-type: none"> Identify suitable analytical capacity for PCBs in Ghana. Establish reference methods for measuring content of PCBs in closed, partially closed and open applications. Test for the actual presence and concentrations of PCBs in these applications and in new imported transformers oils of (dubious origin). 	PCBs in equipment identified and analysed.	5 years	EPA, GAEC, GSB, VRA, ECG, Research Institutions	Financial assistance, Sampling equipment, Training
(3) To develop a database on PCBs in Ghana (See 3.3.3 activity 2)	<ul style="list-style-type: none"> Establish a database of results of analysis. 	Database established	2 years	EPA, GAEC, GSB, VRA, ECG, Research Institutions	Computer software and hardware, Training, Technical expertise

Table 14 Continued

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(4) To prohibit the import and use of PCBs and PCB containing equipment and materials. (See 3.3.1 activity 1)	<ul style="list-style-type: none"> • Draft new regulations on imports, use, of PCBs and PCB containing equipment. • Establish policies and guidelines for the management of PCBs including those on imports to Ghana • Identify safer substitutes. • Develop detailed phase out programmes for organisations and institutions using of PCBs. 	<ul style="list-style-type: none"> • Legislation passed • Policies/guidelines initiated • Safer substitutes identified • Phase out programme developed 	5 years	EPA, AG, Parliamentary Select Committee On Environment. MES, MOE, EPA VRA, ECG	Financial assistance Consultants, Equipment
(5) To promote measures to reduce exposure to Human health and environment to PCBs in use.	<ul style="list-style-type: none"> • Place warning notices near equipment, especially where decommissioned ones are kept prior to disposal. • Regularly inspect PCB containing equipment. • Install receptor tanks to replace concrete bunds. • Establish emergency plans for PCBs spillage and accidents. • Organize training for personnel involve in handling of PCBs. • Establish mechanism for reporting accidents to authorities. 	<ul style="list-style-type: none"> • Warning signs and notices in place • Inspection programme developed • Receptor tanks built • Emergency plans in pace • Training programme organised. • Mechanism for reporting accidents established 	2 years	EPA, VRA, ECG	Financial assistance, Vehicles, Training, equipment.
(6) To ensure safe management of PCBs and PCB containing equipment	<ul style="list-style-type: none"> • Develop guidelines on safe handling of PCBs. • Develop guidelines for collection and transport of PCBs and PCB containing equipment • Establish permitting system for the collection and transport of PCBs and PCB containing equipment • Establish criteria for selection of appropriate storage areas • Procedures to identify appropriate storage sites for PCBs and Equipment containing PCBs. • Develop/upgrade infrastructure for safe storage • Establish system for proper labeling of stored items 	<ul style="list-style-type: none"> • Guidelines on safe handling developed. • Guidelines for collection and transport of PCBs in place • Permitting system established. • Criteria developed • Storage sites established • Storage infrastructure upgraded • Requisite labelling system in place 	10 years	EPA, VRA, ECG, local authorities	Financial assistance, Training, Equipment, Technical expertise / consultants

Table 14 Continued

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(7) To identify and remove from use damaged equipment containing PCBs.	<ul style="list-style-type: none"> Establish appropriate procedures for the decommissioning of damaged equipment or that removed from use and its sound disposal Cleaning of equipment earmarked for decommissioning 	Equipment decommissioned	10 years	EPA, VRA, ECG, local authorities	Financial assistance, Training, Technical expertise / consultants
(8) To build facilities for safe disposal of all PCB and PCB containing equipment	<p>Identifying and finalizing arrangements for the disposal of PCB and PCB containing equipment. Packaging of equipment for disposal.</p> <p>Identify appropriate technology for disposal of PCBs.</p>	Mechanism for disposal established. Procedures for packaging for disposal developed Technology for disposal identified	5 years	EPA, VRA, ECG, International consultants	Training, financial assistance, feasibility studies
(9) To monitor and assess impact of PCBs in human and environmental media	<ul style="list-style-type: none"> Develop programme for the monitoring of the entire PCB management processes. Establish a countrywide programme of monitoring exposure of PCBs in human fluids. Monitor to ensure that PCB reduction is not causing adverse impacts on the industry. Monitor the efficacy and safety of PCBs in areas where they continue to be used until their elimination and disposal. Analysis of food, soil samples and water bodies for presence of PCBs. Analysis of identified PCB contaminated sites 	<ul style="list-style-type: none"> Monitoring programmes in place Analysis programme established Industry feedback Monitoring programme in place Analysis report 	15 years	EPA, GAEC, VRA, ECG, MOH/GHS, GSB	Financial assistance, vehicles, equipment, training
(10) To build the capacity of institutions to handle PCBs and PCB containing equipment and waste.	<p>Identify and Prepare programme for institutional strengthening and capacity building.</p> <p>Involve relevant stakeholder in education and training.</p>	Capacity of institutions developed and strengthened.	5 years	EPA, Research Institutions, VRA, ECG, CEPS	Financial assistance, Training, Technical expertise / consultants
(11) To raise awareness of public on dangers of PCBs to human health and environment. (See 3.3.13)	<p>Develop awareness creation strategy on environmental and health impact of PCBs.</p> <p>Development of a website and information exchange networks on PCBs.</p>	<p>Development of awareness creation materials,</p> <p>Functional Website developed</p>	5 years	EPA, ECG, VRA, GES, AGI, MOH/GHS, MOFA, Oil Marketing Companies	Financial assistance, vehicles, Training, Technical expertise / consultants

Table 15: Production, Import and Export, Use, Stockpiles and Wastes of DDT (Annex B Chemicals).

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(1) To update inventory of Production, Import and Export, Use, Stockpiles and Wastes of Annex B chemicals	Carry out further inventory into the Production, Import, and Export, Use, Stockpiles and Wastes of Annex B chemicals	Inventory report	1 year	EPA, MOH/GHS, Relevant stakeholders	Finance, Laboratory Equipment, Human Resource
(2) Develop data management system for the Annex B chemicals	Archiving and data management system	Data base established	6 months	EPA, Relevant Stakeholders CEPS, MOH/GHS	Training in database management

Table 16: Register for Specific Exemptions and the Continuing need for Exemptions (Article 4)

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource/Needs
To establish register on specific exemptions on POPs.	<p>(a) Organize stakeholder consultation to establish criteria for selection of chemicals requiring exemptions under chemicals listed under Annex A or B.</p> <p>(b) Develop procedures for identification and selection of candidate chemicals</p> <p>(c.) Develop protocols for the notification of convention secretariat on specific exemptions required.</p> <p>(d) Establish registration center to register chemicals proposed for exemptions</p> <p>(e) Periodic review to assess need for continued exemptions or otherwise</p>	<p>Stakeholder meetings held</p> <p>Criteria for selection developed</p> <p>Notification reports submitted</p> <p>Modalities for the operations of the center established</p> <p>Seminar, Meetings held</p>	Annually	EPA, MES, CEPS	Financial assistance, Computer, software and hardware

Table 17: Measures to Reduce Releases from Unintentional Production (Article 5)

Objectives	Activities	Key performance indicators	Time Frame	Key Implementers	Resource /Needs
(1) To update sources existing inventories of unintentional production of PCDD/F, HCB and PCBs and release in Ghana.	<ul style="list-style-type: none"> ▪ Review of preliminary inventory. ▪ Incorporate new source categories. ▪ Collect and collate data from identified source categories 	Inventory updated	3 year	Task team, EPA	Financial assistance, tool kit
(2) To develop data management systems for unintentional production of PCDD/F, HCB and PCBs and release in Ghana.	<ul style="list-style-type: none"> ▪ Develop Database ▪ Archiving and data management 	Database developed	3 year	EPA, Consultant	Training
(3) To establish appropriate policy and legislation for effective regulation and enforcement of prevention of unintentional production of PCDD/F, HCB and PCBs in Ghana. (See 3.3.1)	<ul style="list-style-type: none"> ▪ Draft new regulations. ▪ Prepare memorandum of understanding (MOUs) with industry groups on phasing out equipment and machinery, which are sources of releases. ▪ Introduce substitute technologies or modify materials and processes to prevent formation and releases. ▪ Institute a chemical and materials policy, which aims to reduce/eliminate PCDD/F, HCBs and PCBs. ▪ Integrate industry commitment into existing EPA permitting system. ▪ Education and awareness of stakeholders on legal issues. (See 3.3.13). 	<p>Regulations in place. Modalities for MOUs established</p> <p>Investigations into finding substitutes initiated Policy determined</p> <p>Permitting system integrated</p> <p>Workshops/seminars</p>	3 years	EPA, AG Parliamentary select committee on environment, (PSCE), MES, DA	Financial assistance, Technical expertise / Consultant
(4) To phase out activities using chemicals containing chlorine that are sources of unintentional releases of PCDD/F, HCB and PCBs	<ul style="list-style-type: none"> ▪ Identify activities using chemicals containing chlorine (e.g. PVC production, chlorine in water treatment, pesticides). ▪ Develop phase out programmes for identified sources. ▪ Identify and promote feasible and affordable alternatives to activities, which are chlorine based, and sources of releases. 	<p>Chlorine based activities identified.</p> <p>Phase out programmes in place</p> <p>Suitable alternatives identified</p>	15 years	EPA, AGI, GWCL, MLG, CEPS MES, MWH, MI/PSI MOH/GHS	Technology Transfer, Finance assistance, Logistics

Table 17: Measures to Reduce Releases from Unintentional Production (Article 5) continued

Objectives	Activities	Key performance indicators	Time Frame	Key Implementers	Resource /Needs
(5) To reduce/eliminate release into environment of PCDD/F, HCB and PCBs from uncontrolled burning activities, including waste burning and accidental fires.	<ul style="list-style-type: none"> ▪ Review and develop by-laws, guidelines and procedures for uncontrolled burning activities. ▪ Intensify on-going educational and awareness programmes on effects of uncontrolled burning activities. ▪ Develop alternative methods of bush clearing instead of burning. ▪ Promote other income generating activities for the youth. ▪ Enforce ban on bush and waste burning at dumpsite by local authorities. ▪ Establish mechanism for the prevention and early detection of dumpsite fires. ▪ Constructions of well-designed waste incinerators e.g. waste to energy plants. ▪ Sensitize waste management operators on the environmental impacts of waste burning and burning in general. ▪ Develop educational material on the health and environmental effects of burning of materials suspected to be emission sources. ▪ Expand on-going landfill site development and composting plants. ▪ Implement policy to ban burning of products containing chlorine or processed with chlorine, such as chlorinated chemicals, polyvinyl chloride plastic and chlorine bleached paper. ▪ Integrate Stockholm Convention obligations into existing byelaws. ▪ Strengthen institutions to implement cleaner technologies 	<p>By-laws and guidelines on waste burning reviewed/developed. Awareness created</p> <p>Alternative methods for bush clearing identified Options for Income generating activities Laws on bush and waste burning enforced Proper waste dumps developed</p> <p>Incinerators constructed and operational Workshops/training for waste managers</p> <p>Educational materials developed</p> <p>Composting plants reactivated and landfill sites operating. Policy to ban chlorine containing products in place</p> <p>Convention obligation integrated into existing byelaws.</p> <p>Training on cleaner technologies</p>	10 years	EPA, DA, Traditional Authorities, MLG, AG, GNFS, NGO'	Financial assistance, Vehicles, Training, Technical Expertise, Technology Transfer

Table 17: Measures to Reduce Releases from Unintentional Production (Article 5) continued

Objectives	Activities	Key performance indicators	Time Frame	Key Implementers	Resource / Needs
(6) To eliminate/reduce releases of PCDD/F, HCBs and PCBs from incineration of medical waste	<ul style="list-style-type: none"> ▪ Develop a phase out strategy for all old and existing methods of incineration in hospitals and health centers. ▪ Construct modern incinerators with designs to improve combustion of medical waste. ▪ Integrate international emission discharge limits of PCDD/F, HCBs and PCBs to air into national standards. ▪ Develop institutional and human resource capacity to implement national medical waste management guidelines 	<p>Efficient waste management systems established at all health centres.</p> <p>Medical waste incinerators built and operational.</p> <p>Modalities for integration established</p> <p>Workshops/training</p>	5 years	EPA MOH/GHS, DAs	Technical Expertise, Consultant, Technology Transfer, Financial assistance
(7) To promote the use of alternative methods of household fuel for cooking.	<ul style="list-style-type: none"> ▪ Promote use of gas-fired stoves, solar systems and ovens. ▪ Establish alternative energy use demonstration centers ▪ Sensitize public on the environmental and health impacts of burning wood fuels and benefits that accrue from energy efficiency initiatives. ▪ Research into use of alternative energy sources in households. 	<p>Policy on LPG reviewed.</p> <p>Demonstration centres established.</p> <p>Awareness created.</p> <p>Alternatives energy sources available.</p>		MOE, EPA, DAs, CSIR, MLG, Private Sector Development	Technical assistance, Technology transfer, Financial assistance.
(8) To reduce/eliminate releases of PCDD/F, PCBs and HCBs, from the transport sector.	<ul style="list-style-type: none"> ▪ Support implementation of leaded fuel phase out programme. ▪ Sensitize motorists on the need for the adoption of fuel efficiency initiatives. ▪ Encourage reliance on mass transportation system to reduce fuel consumption. ▪ Develop vehicle emission regulations and standards. ▪ Enforce permitting conditions for fuel service centres. 	<p>Training workshops organized to implement leaded phase out programme.</p> <p>Sensitisation workshops carried out.</p> <p>Compliance and Enforcement Network established.</p> <p>Emission regulations standards developed.</p> <p>Compliance and Enforcement Network monitoring.</p>	5 years	EPA, MOE, MOT, MPRH, DVLA, Police, Transport Unions / associations	Equipment, Technical Expertise, Financial Assistance.

Table 17: Measures to Reduce Releases from Unintentional Production (Article 5) continued

Objectives	Activities	Key performance indicators	Time Frame	Key Implementers	Resource /Needs
(9) To promote the adoption of best practice in foundry process to reduce/eliminate emissions	<ul style="list-style-type: none"> ▪ Develop best practice guidelines on the selection of scrap metal for processing for small-scale foundry set-ups. ▪ Develop and integrate discharge limit for secondary metal processing into draft regulations on emissions. ▪ Integrate control of chlorine content in waste discharge by industry into permitting system. 	<p>Workshops to develop guidelines on best practice.</p> <p>Discharge limits developed Permitting system reviewed and updated to include discharge limits of chlorine content in waste.</p>	5 years	EPA, AGI, NBSSI, GRATIS, IIR/CSIR, KNUST, Research institutions.	Financial assistance, Technical expertise, Equipment, Technology transfer.
(10) To create awareness on the health and environmental effects of release from PCDD/F, HCBs and PCBs. (See 3.3.13)	<ul style="list-style-type: none"> ▪ Sensitize industry and relevant stakeholders on the generation elimination/reduction of PCDD/F, HCBs and PCBs, through seminars, workshops and training programmes. ▪ Sensitize the general public on the health effect of PCDD/F, HCBs and PCBs. through Radio and Television discussions and advertisement. ▪ Develop educational /awareness materials on the health and environmental effects of PCDD/F HCBs and PCBs. ▪ Develop a comprehensive database on PCDD/F, HCBs and PCBs. 	<p>Workshop and seminars organised.</p> <p>TV and radio discussions held</p> <p>Education materials developed</p> <p>Database on PCDD/F, HCBs and PCBs</p>	5 years	EPA, NGOs, GES, MOH, ISD, media	Financial assistance, Environmental fund, Vehicles, Technical expertise / Consultants
(11) To monitor the release of PCDD/F, HCBs and PCBs	<ul style="list-style-type: none"> ▪ Monitor conditions, types and sources of generation of PCDD/F, HCBs and PCBs ▪ Sample and analyse human tissues/organs and foods samples. ▪ Continuous study of conditions and processes generating the emissions. ▪ Integrate information/results into database management system 	<p>Functional laboratories in place for monitoring</p> <p>Sampling Programme established Study initiated Database in place</p>	10 years	EPA, GSB, Noguchi, Universities	Financial assistance, Vehicles, Equipment, Technical expertise / consultants Laboratories

Table 18: Measures to Reduce Releases from Stockpiles and Wastes (Article 6).

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(1) To identify sites and assess potential for releases from stockpiles and waste.	<ul style="list-style-type: none"> ▪ Identify sites where chemicals have been stockpiled or waste dumped. ▪ Quantitative inventory of the potential for releases from stockpiles and waste into environmental media 	<ul style="list-style-type: none"> ▪ Sites identified ▪ A criteria for assessment of releases established 	2 years	EPA, MOFA, GHS/MOH, Relevant Stakeholders	Financial assistance Vehicles, Training And Technical Expertise
(2) To assess mode and determined level of releases from stockpiles and waste	<ul style="list-style-type: none"> ▪ Develop method for estimating the potential for releases. ▪ Sample soil, water, human tissues and fluids, tissue of fauna and flora from selected sites to determine residues and presence of annex A, B and C chemicals ▪ Review of health records of populations exposed to waste and stockpiles of annex A, B and C chemicals. ▪ Assess conditions and procedures for storage of stockpiles and waste of annex A, B and C chemicals. 	<ul style="list-style-type: none"> ▪ Method for estimating potential for releases developed ▪ Develop selection criteria and laboratory analysis carried out ▪ Health records of exposed populations collated and analysed. ▪ Assessment for storage of stockpiles and waste established 	5 years	EPA, MOFA, Relevant Stakeholders Research Institution	Financial assistance Vehicles, Training And Technical Expertise
(3) To prevent the releases from waste and stockpiles of annex A, B and C chemicals in order to safeguard human health and environment.	<ul style="list-style-type: none"> ▪ Secure and label sites having stockpiles and waste of annex A, B and C chemicals to prevent releases from spreading. Identify potential remediation technologies available. ▪ Train and upgrade skills of personnel in the application of identified remedial measures and safe handling. ▪ Establish regulations and guidelines for reporting of leakages or spillages and clean-up of contaminated sites ▪ Monitor surface and ground water. Establish programme for continued education and training in clean up in areas contaminated by waste and stockpiles. ▪ Develop procedures on inspections and maintenance of stockpiles and waste. 	<p>Sites identified and secured.</p> <p>Best remediation measures identified.</p> <p>Training programme developed.</p> <p>Guidelines and regulations established.</p> <p>Monitoring programme.</p> <p>Education programme developed</p> <p>Procedures on inspections and maintenance of stockpiles and waste developed.</p>	15 years	EPA, MOFA, CSIR, Relevant Stakeholders GHS/MOH	Equipment, Vehicles, Technical expertise, Financial assistance.
(4) To make information accessible to the public (See 3.3.13)	<ul style="list-style-type: none"> ▪ Organise public awareness programme to disseminate information ▪ Establish collection points or scheme to encourage voluntary return of damaged or out of use equipment. ▪ Prepare of information and awareness education materials. 	<p>Workshops, Seminar, Radio and TV programmes organised.</p> <p>Collection points /scheme established.</p> <p>Awareness creation materials developed.</p>	5 years	EPA, ISD, NGO'S	Financial assistance, Vehicles Technical Expertise / consultants.

Table 19: Identification of Stockpiles, Articles in Use and Wastes

Objective	Activities	Key performance indicators	Time frame	Implementers	Resource / Needs
(1) To identify POPs stockpiles	<ul style="list-style-type: none"> ▪ Identify sources of information and stocks of POPs stockpiles in Ghana. ▪ Design questionnaire to collect information and quantify stocks of stockpiles. ▪ Collect information ▪ Organise workshops on the collation of data on stockpiles. 	<ul style="list-style-type: none"> ▪ POPs stockpiles identified and compiled. ▪ Survey to collect information carried out. ▪ Workshop on data collection organised. 	6 months	EPA, Relevant Stakeholders	Finance, Personal Protective Equipment, Logistics, Human Resource.
(2) To identify POPs articles in use (See 3..3.4)	<ul style="list-style-type: none"> ▪ Identify sources of information and stocks of POPs articles in use in Ghana. ▪ Design questionnaire to collect information and quantify stocks of articles in use. ▪ Collect information. ▪ Organise workshops on the collation of data. 	<ul style="list-style-type: none"> ▪ POP articles in use identified and compiled ▪ Survey to collect information carried out ▪ Workshop organised 	6 months	EPA, Relevant Stakeholders	Finance, Personal Protective Equipment, Logistics, Human Resource
(3) To identify POPs waste	<ul style="list-style-type: none"> ▪ Identify sources of information and stocks of POPs waste. ▪ Design questionnaire to collect information and quantify stocks of waste. ▪ Collect information. ▪ Organise workshops on the collation of data. 	<ul style="list-style-type: none"> ▪ POP waste identified and compiled. ▪ Survey to collect information carried out. ▪ Workshop organised 	6 months	EPA, Relevant Stakeholders	Finance, Personal Protective Equipment, Logistics, Human Resource

Table 20: Measures to Manage Stockpiles and Appropriate Measures for Handling and Disposal of Articles in Use

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource /Needs
(1) To manage stockpiles in a safe and environmentally sound manner (See 3.3.3. and 3.3.4)	<ul style="list-style-type: none"> ▪ Identify appropriate storage facilities for interim storage of stockpiles ▪ Upgrade existing information for safe management of stockpiles 	<ul style="list-style-type: none"> ▪ Meetings to develop guidelines for safe storage ▪ Facilities to handle stockpiles in place ▪ Workshops to train personnel in management of stockpiles 	2 years	EPA, MOFA, DAS MOH/ECG, VRA	Financial assistance, Technical Expertise/Consultants
(2) To develop measures for safe handling and sound disposal of articles in use. (See 3.3.9)	<ul style="list-style-type: none"> ▪ Develop manuals for safe handling and disposal. ▪ Develop guidelines for the transport of articles in use to safe locations. ▪ Establish collection centres or scheme for articles in use. 	<ul style="list-style-type: none"> ▪ Meetings to develop manuals for safe handling and disposal ▪ Guidelines on transport developed ▪ Collections points/scheme for articles in use established 	5 Years	EPA, MOFA, DA, MOH, ECG, VRA	Financial assistance, Technical Expertise/Consultants

Table 21: Identification of Contaminated Sites (Annex A, B and C Chemicals) and Remediation in an Environmentally Sound Manner

Objectives	Activities	Key performance indicators	Time Frame	Implementers	Resource / Needs
(1) To identify sites contaminated with Annex A, B and C chemicals	<ul style="list-style-type: none"> ▪ Carry out further investigations to identify contaminated sites 	Procedures for investigations developed	5 years	EPA, Task Team, Research institutions	Financial assistance Protective Equipment, Technical expertise, Vehicles
(2) To institute remediation measures for identified contaminated sites	<ul style="list-style-type: none"> ▪ Secure and label sites. ▪ Identify potential remediation technologies available. ▪ Establish regulations and guidelines for clean-up of contaminated sites ▪ Train and upgrade skills of personnel in the application of identified remedial measures. 	<ul style="list-style-type: none"> ▪ Contaminated sites clearly identified and isolated. ▪ Selection of available environmentally sound remediation methods ▪ Training programmes drawn ▪ Draft regulations and guidelines on clean up procedures 	10 years	EPA, Task Team, Research institutions	Financial assistance Protective Equipment, Technical expertise, Vehicles

Table 22: Facilitating or undertaking Information Exchange and Stakeholder Involvement

Objectives	Activities	Key performance indicators	Time Frame	Implementers/ Collaborators	Resources /needs
(1) To establish a national focal point for the exchange of information.	<ul style="list-style-type: none"> ▪ Designate national focal point for information exchange ▪ Identify appropriate information required for information exchange ▪ Recruit professional and auxiliary staff e.g. data analysts, information technologists, public relations officers etc ▪ Purchase and install equipment e.g. communication gadgets, computers, ▪ Subscribe to Internet websites with links to sources listed in the national inventory. ▪ Develop internet website 	<ul style="list-style-type: none"> ▪ National focal point established ▪ Required information identified ▪ List of recruited professionals available ▪ Communications equipment installed ▪ Website developed 	2 years	EPA, MES, Information Services Ministry of Information, MOC &T	Financial assistance, Technical Expertise, Equipment.
(2) To equip staff with relevant skills	<ul style="list-style-type: none"> ▪ Train staff at focal point with relevant skills 	<ul style="list-style-type: none"> ▪ Trained staff at national focal point. ▪ Training workshop reports available. 	18 months	EPA, MES,	Financial assistance, Technical Expertise, Equipment
(3) To strengthen national capacity to collect and use multi sectoral information.	<ul style="list-style-type: none"> ▪ Identify the resource persons ▪ Carry out needs assessment ▪ Develop training materials and programmes. ▪ Carry out training. 	<ul style="list-style-type: none"> ▪ Resource persons identified ▪ Needs assessment report ▪ Training materials developed ▪ Training organised 	1 year	CEPS, ECG, EPA, FDB, GSB, PPRSD, MOH etc	Financial assistance, Technical Expertise, Equipment
(4) To obtain Stakeholder commitment	<ul style="list-style-type: none"> ▪ Identify relevant stakeholder institutions/partners ▪ Communicate with identified stakeholders ▪ Obtain feedback from stakeholders ▪ Involve stakeholders in programmes 	<ul style="list-style-type: none"> ▪ Communications equipment installed. ▪ Communication via internet 	2 years	MES, EPA	Financial assistance, Equipment

Table 23: Public awareness, information and Education (Article 10)

Objectives	Activities	Key performance indicator	Time frame	Key implementers	Resource/ Needs
(1) To develop and produce public awareness programme on POPs	<ul style="list-style-type: none"> ▪ Develop and produce awareness raising materials e.g. brochures, flyers, posters, newsletters etc on POPs. ▪ Translate materials into local languages. ▪ Develop radio and TV education programmes e.g. prepare synopsis, write scripts for local drama etc to cater for the needs of women, children and the non-formal society ▪ Place articles for publication in both private and state-owned newspapers. 	<ul style="list-style-type: none"> ▪ Awareness raising materials developed and produced. ▪ Awareness raising materials in local languages produced ▪ Radio and TV programmes ▪ Feature articles published in newspapers 	2 years	EPA, MES, ISD, Relevant stakeholders	Financial assistance, equipment, vehicles, digital cameras, recorders, video and projector.
(2) To create awareness among policy and decision makers/traditional authorities on POPs	<ul style="list-style-type: none"> ▪ Identify relevant decision and policy makers/traditional authorities. ▪ Organise workshops/seminars to sensitise identified groups 	<ul style="list-style-type: none"> ▪ List of identified relevant policy/decision makers/traditional authorities. ▪ Workshops/seminars organized. 	1 year	EPA, MES, Relevant stakeholders.	Financial assistance, training materials, technical expertise.
(3) To implement public education programmes.	<ul style="list-style-type: none"> ▪ Provide the Information Services Department and the media houses with information materials ▪ Identify resource persons to carry out public education e.g. representatives of various organisations and institutions, public interest groups, NGOs, media, traditional authorities. ▪ Train identified resource persons. ▪ Collaborate with MOE/GES to integrate POPs management in the environmental education syllabus of basic and secondary schools ▪ Design programme with electronic and print media houses to discuss/publish POPs related issues. 	<ul style="list-style-type: none"> ▪ Information on POPs for ISD ▪ List of resource persons ▪ Workshops organised for resource persons ▪ Suggested syllabus on POPs in place. ▪ Allocated airtime and space. 	5 years	EPA, GES, Media. Relevant stakeholders	Financial assistance, vehicles, sponsors.
(4) To promote public awareness in addressing effect of POPs on human health and environment	<ul style="list-style-type: none"> ▪ Promote benefits of use of alternatives to POPs ▪ Organise programmes on POPs such as radio competitions, quizzes for schools, radio and TV phone-in programmes 	<ul style="list-style-type: none"> ▪ Promotion programmes organised ▪ Programmes on POPs organised 	5 years	EPA, Media Relevant Stakeholders	Financial assistance Vehicles, Technical Expertise

Table 23: Public awareness, information and Education (Article 10) continued

Objectives	Activities	Key performance indicator	Time frame	Key implementers	Resource / Needs
(5) To compile and collate information on POPs in Ghana (see 3.3.12)	<ul style="list-style-type: none"> ▪ Establish Information Centres. ▪ Develop mechanisms for the collection of information on chemicals listed in Annexes A, B and C 	<ul style="list-style-type: none"> ▪ Assessment of needs of information centre ▪ Mechanisms developed 	2 years	MES, EPA Relevant Stakeholders	Financial assistance, Technical Expertise
(6) To promote and facilitate information dissemination.	<ul style="list-style-type: none"> ▪ Develop websites, and newsletters. ▪ To promote the dissemination of information on POP's to Ministries, department and agencies. (MDAs). 	<ul style="list-style-type: none"> ▪ Websites, newsletters. ▪ Leaflets, brochures supplied to MDAs 	6 months	EPA, MES, MLG Relevant Stakeholders	Financial assistance, Technical Expertise
(7) To train workers, scientists, educators, technical and managerial personnel of relevant institutions	<ul style="list-style-type: none"> ▪ Develop course modules for various categories of personnel. ▪ Produce training materials for training workshops. ▪ Organise workshops and seminars. 	<ul style="list-style-type: none"> ▪ Course modules designed. ▪ Training materials developed. ▪ Workshop/seminar reports. 	2 years	EPA Relevant Stakeholders	Financial assistance, Vehicles, Technical Expertise

Table 24: Effectiveness Evaluation (Article 16)

Objectives	Activities	Key performance indicator	Time frame	Key implementers	Resource / Needs
(1) To evaluate the effectiveness of the implementation of the Convention in Ghana	<ul style="list-style-type: none"> ▪ Develop an evaluation programme. ▪ Develop checklist or format for evaluation. ▪ Develop national performance evaluation criteria. 	<ul style="list-style-type: none"> ▪ Evaluation programme prepared. ▪ Checklist in place. ▪ Criteria Developed. 	2 years	EPA, Relevant Stakeholders	Financial assistance, Technical Expertise
(2) To report on evaluation results	<ul style="list-style-type: none"> ▪ Mechanism for reporting established ▪ Preparation of evaluation report 	<ul style="list-style-type: none"> ▪ Periodic reports showing monitoring performance. ▪ Evaluation report. 	2 years	EPA, Relevant Stakeholders	Financial assistance, Technical Expertise

Table 25: Reporting

Objectives	Activities	Key performance indicator	Time frame	Implementers	Resource / Needs
(1) To report on measures taken to implement provisions of the Stockholm Convention	<ul style="list-style-type: none"> ▪ List measures developed to implement provision of convention. ▪ Develop reporting format in line with convention format ▪ Identify software to report statistical data and results of implementation of the Stockholm Convention 	<ul style="list-style-type: none"> ▪ Checklist of measures developed ▪ Reporting format ▪ Software identified 	Every 2 years	EPA	Financial Assistance.
(2) To report on measures taken to reduce or eliminate releases from intentional production and use of annex A and B chemicals	<ul style="list-style-type: none"> ▪ Provide report on following: ▪ Legal/administrative measures taken to eliminate the production and use of Annex A chemicals with dates ▪ Measures taken to restrict the production and/or use of Annex B chemicals with dates. ▪ Legal or administrative measures necessary to eliminate the import/export of chemicals listed in Annex A of Convention ▪ Measures regarding the import/export of chemicals listed in Annex B of Convention. 	Report available	Every 2 years	EPA	Financial Assistance.
(3) To report on measures to reduce or eliminate releases from unintentional production	<ul style="list-style-type: none"> ▪ Provide report on following: <ol style="list-style-type: none"> i) Action Plan to identify, characterize and address release of Annex C chemicals ii) Implementation of Action Plan iii) Difficulties and successes of implementation ▪ Evaluation of current and projected releases from anthropogenic sources of chemicals listed in Annex C of Convention by the following specific actions: <ol style="list-style-type: none"> i) Development of format for evaluation comprising <ul style="list-style-type: none"> • Source category • Annual releases (gTEQ/a) to air, water, land, product and residue ▪ Generation of data for current releases ▪ Generation of data for projected releases ▪ Analysis of data and compilation of report ▪ Review of strategies and of their success in meeting the obligations of Article 5. 	Report available	Every 2 years	EPA	Financial Assistance.

Table 25: Reporting Continued

Objectives	Activities	Key performance indicator	Time frame	Implementers	Resource / Needs
(4) To report on measures to reduce releases from stockpiles and wastes.	<ul style="list-style-type: none"> ▪ Design data collection/inventory format for collection of data on: <ol style="list-style-type: none"> i) Stockpiles consisting of or containing chemicals listed in either Annex A or B i.e. type of chemical, quantity of stock, location and condition of stock ii) Products and articles in use and wastes containing or contaminated with chemicals listed in Annex A, B or C. ▪ Conduct training on use of inventory format ▪ Collection of data ▪ Analysis of data and compilation of report. ▪ Report on legislative or/and administrative measures to manage stockpiles. 	Report available	Every 2 years	EPA	Financial Assistance, Technical Assistance, Vehicles
(5) To provide inventory on total quantities of production, importation and exportation of chemicals listed in Annexes A&B of Convention	<ul style="list-style-type: none"> ▪ Design and pilot test an inventory format for collection of data on name of chemical, total annual production (kg/yr), total annual import (kg/yr) and countries of origin, total annual export and destination countries. ▪ Train collaborating stakeholders e.g. CEPS, EPA, GSB, Factories Inspectorate Division etc on use of inventory format ▪ Collection of data at various sources of illegal entry points in Ghana ▪ Analysis and compilation of report. 	Report available	Every 2 years	EPA	Financial Assistance Technical Assistance
(6) To report on progress in eliminating polychlorinated biphenyls (PCBs)	<ul style="list-style-type: none"> ▪ Provide report on following: ▪ Measures taken to eliminate the use of PCBs in equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) by 2025. ▪ Measures taken to reduce exposures and risk and to control the use of PCBs ▪ Measures taken to ensure that equipment containing PCBs are not exported or imported except for the purpose of environmentally sound waste management. 	Report available	Every 2 years	EPA, ECG, VRA	Financial Assistance,

Table 25: Reporting Continued

Objectives	Activities	Key performance indicator	Time frame	Implementers	Resource / Needs
(7) To report on Information Exchange	<ul style="list-style-type: none"> ▪ Provide report on following: ▪ Establishment of information exchange mechanism ▪ Designation of national focal point for information exchange 	Report available	Every 2 years	EPA	Financial Assistance
(8) To report on Public Information, Awareness and Education	<ul style="list-style-type: none"> ▪ Provide report on measures taken to implement public information, awareness and education 	Report available	Every 2 years	EPA	Financial Assistance
(9) To report on Research, Development and Monitoring.	<ul style="list-style-type: none"> ▪ Report on following: ▪ Measures taken to encourage research, development and monitoring of POPs including sources and releases into the environment, presence, levels and trends in humans and the environment etc as listed in Article 11 paragraph 1 of the Stockholm Convention. ▪ Development of format for presentation of results/reports. ▪ Sensitisation of stakeholders e.g. researchers, academia, on need to submit regular reports/findings to national focal point using format developed for presentation. ▪ Generation of reports from information centres e.g. Poison control and information centres ▪ Measures taken to store and maintain information generated from research, development and monitoring ▪ Overall report on research, development and monitoring. 	Report available	Every 2 years	EPA	Financial assistance, Technical assistance e.g. data analysts

Table 26: Research, Development and Monitoring (Article 11)

Objectives	Activities	Key performance indicator	Time frame	Key implementers	Resource /Needs
(1) To develop institutional and research capacity to manage POPs	<ul style="list-style-type: none"> ▪ Identify institutions with the potential to undertake research into POPs ▪ Strengthen national scientific and technical research capabilities and infrastructure to promote assess to exchange of data and analysis ▪ Develop mechanism for networking among identified research institutions ▪ Undertake research aimed at alleviating the effects of POPs on reproductive health ▪ Establish procedures for communicating research and development findings to the public. ▪ Undertake research to identifying alternatives to POPs. 	<ul style="list-style-type: none"> ▪ Mechanism for identifying institutions in place ▪ Needs of national scientific and technical research capabilities relation to POPs established ▪ Meetings to identify proper avenues for networking ▪ Research into the alleviation of effects of POP on reproductive health initiated ▪ Linkages for communication established ▪ Research initiatives into finding alternatives to POPs 	10 years	EPA, Laboratory experts, GSB, GAEC, Tertiary Institutions, CSIR	Financial Assistance, Vehicles, Technical expertise Consultants
(2) To identify appropriate laboratories to monitor all POPs activities	<ul style="list-style-type: none"> ▪ Compile list of existing laboratories (See National Profile on Chemicals). ▪ Develop criteria for the assessment of capacities of existing laboratories to analyse POPs. ▪ Assess and select laboratories. 	<ul style="list-style-type: none"> ▪ Data base of existing laboratory ▪ Stakeholder consultations to identify assessment criteria for listing laboratories ▪ Stakeholder consultation to assess and select laboratory. 	1 year	EPA, Laboratory experts, GSB, GAEC, Tertiary institutions, CSIR	Financial Assistance, Vehicles, Technical expertise Consultants.
(3) To upgrade two laboratories capable of analyzing Annexes A and B Chemicals	<ul style="list-style-type: none"> ▪ Upgrade infrastructure of two laboratories to analyse Annexes A and B chemicals. 	<ul style="list-style-type: none"> ▪ Laboratories established ▪ Equipment purchased ▪ Staff trained 	5 years	EPA, GAEC, MFA, CSIR, Research Institutions Universities	Financial Assistance, Vehicles, Technical expertise Consultants.
(4) To monitor levels of concentration of POPs in the environment.	<ul style="list-style-type: none"> ▪ Select matrices to sample ▪ Determine appropriate methods of sampling and analysis to apply ▪ Analysis of soil, air water, human milk, other biota for presence of POPs. 	<ul style="list-style-type: none"> ▪ Sample matrices identified ▪ Methods for sampling selected ▪ Sample collected ▪ Analysis Results 	10 years	EPA, GAEC, GSB, CSIR, Universities EPA, stakeholders	Financial Assistance, Vehicles, Technical expertise / consultants
(5) To undertake proper management of data	<ul style="list-style-type: none"> ▪ Establish procedures for the management of analysis results ▪ Develop internationally recognized guidelines for interpreting monitoring results and presenting monitoring reports 	<ul style="list-style-type: none"> ▪ Procedure for management of analysis results established ▪ Harmonized methodology for reporting interpretation of results 	2 years	EPA, stakeholders	Training, Computer software.
(6) To establish mechanism for quality assurance and control of monitoring activities	<ul style="list-style-type: none"> ▪ Establish effective quality assurance and quality control system ▪ Setting up of review panel to evaluate data prior to acceptance 	<ul style="list-style-type: none"> ▪ Protocol for ensuring QA/QC in place ▪ Procedure for data evaluation developed ▪ Workshop to identify review panel organised 	2 years	EPA, stakeholders	Financial Assistance, Training

Table 27: Technical and Financial Assistance (Articles 12 and 13)

Objectives	Activities	Key performance indicator	Time frame	Key implementers	Resource/ Needs
(a) To source for technical assistance towards the successful implementation of the Convention	<ul style="list-style-type: none"> ▪ Assess technical needs ▪ Identify sources of financial assistance 	<ul style="list-style-type: none"> ▪ Documentation of needs ▪ List of sources of technical assistance ▪ Number of proposals prepared and submitted 	1 year	EPA, MES	Technical expertise, financial assistance
(b) To source for financial assistance towards the successful implementation of the Convention	<ul style="list-style-type: none"> ▪ Financial needs assessment ▪ Identify sources of Financial assistance ▪ Requisition for financial assistance through proposal writing 	<ul style="list-style-type: none"> ▪ Documents showing financial needs ▪ List of potential donors identified ▪ Number of proposals prepared and submitted 	1 year	EPA, MES	Technical expertise, Financial assistance

Table 28 Development and Capacity Building Proposals and Priorities

No.	Project Purpose	Objectives	Time Frame	Budget (USD)
1	Strengthen human and institutional capacity for the management of POPs	<ul style="list-style-type: none"> Develop guidelines for the safe and environmentally sound production, usage, transportation, storage, handling and disposal of POPs and POPs containing equipment. Develop policy and legislation for the management and control of POPs. Develop capacities in relevant institutions for the management of POPs. Promote coordination of activities of relevant institutions on POPs 	2 years	190,300
2	To develop capacity and capability for the identification, analysis and monitoring of POPs in the environment.	<ul style="list-style-type: none"> Upgrade at least two (2) laboratories and acquire analytical equipment for analysing POPs Train staff to run laboratories. Assess levels of POPs in the environment. 	5 years	3,218,000
3	To develop and implement information and communication system for the management of POPs.	<ul style="list-style-type: none"> Establish national data and information centre on POPs Formulate and implement communication strategy on POPs. Promote networking among stakeholders at the national and international levels. Establish poison information and management centres. 	1 year	133,100
4	Investigate and assess the nature and severity of health effects experienced by humans as a result of exposure to Persistent Organic Pollutants (POPs)	<ul style="list-style-type: none"> Estimate nature and severity of health effects experienced by high risk groups Recommend opportunities for management interventions required to reduce identified adverse effects and risks to acceptable levels. Strengthen capacity of health centres to handle POPs poisoning 	2 years	347,200
5	To undertake safe and environmentally sound (SES) treatment and disposal of POPs, POPs-laden equipment and remediation of contaminated sites.	<ul style="list-style-type: none"> Enhance capabilities of line institutions and for the safe and environmentally sound (SES) collection, transportation and storage of POPs. Private sector participation in the SES collection, transportation, storage, treatment and disposal of POPs promoted. Identify and rehabilitated and/or redesign facilities for the SES storage and disposal of existing POPs pesticides and POPs-containing equipment. Develop procedures for the SES treatment and disposal of POPs pesticides, PCBs and PCPs-containing equipment. Conduct treatment and disposal of existing stockpiles of PCP-containing equipment, POPs pesticides. 	5 years	3,825,000

**ENVIRONMENTAL
PROTECTION AGENCY -
GHANA**



**NATIONAL IMPLEMENTATION
PLAN OF THE STOCKHOLM
CONVENTION ON PERSISTENT
ORGANIC POLLUTANTS
(LIST OF ANNEXES)**

ACCRA, DECEMBER 2007

LIST OF ANNEXES

Annex I	Schematic Representation of the NIP Process
Annex II	Pesticides Control and Management Act, 1996 (Act 528)
Annex II	Details of Sub-Categories of Sources of PCDD/PCDF in Ghana
Annex IV	Draft National Environmental Quality Standards Regulations
Annex V	List of Active NGOs Registered with the Environmental Protection Agency
Annex VI	List of National Stakeholders
Annex VII	Main Proposals and Priorities

**ANNEX II: PESTICIDES CONTROL AND MANAGEMENT ACT, 1996, ACT 528
ARRANGEMENTS OF SECTIONS**

Sections

PART I – REGISTRATION OF PESTICIDES

1. Requirement for registration of pesticides
2. Exceptions to section 1
3. Application for registration of pesticides
4. Classification of pesticides
5. Pesticides for general use
6. Restricted and suspended pesticides
7. Matters to be considered in registration and classification of pesticides
8. Approval
9. Provisional clearance
10. Duration and renewal of provisional clearances
11. Refusal to register pesticides
12. Duration of registration and renewal of registration
13. Non-disclosure of information
14. Power of Agency to amend, ban or suspend pesticides
15. Register of pesticides
16. Gazette publication

PART II – LICENSING OF PESTICIDES DEALERS

17. Requirement for licence to deal in pesticides
18. Exemptions
19. Application for dealers licence
20. Issue of dealer's licence
21. Safeguards for use of pesticides
22. Suspension, cancellation of licence
23. Appeal
24. General regulatory power
25. Conformity to registered pesticides
26. Advertising of registered pesticides
27. Containers and packaging of pesticides
28. Records and reporting

Sections

- 29. Exercise of function by the Board
- 30. Pesticides Technical Committee, its composition and functions

PART III – ENFORCEMENT AND PENALTIES

- 31. Power of inspector
- 32. Analysis and certificate
- 33. Obstruction of inspectors
- 34. Other offences and penalties
- 35. Sale of pesticides
- 36. Offences by body of persons
- 37. Forfeiture

PART IV – GENERAL PROVISIONS

- 38. Customs officer
- 39. Power to make regulations
- 40. Fees
- 41. Interpretation
- 42. Transitional provision

THE FIVE HUNDRED AND TWENTY-EIGHTH
ACT
OF THE PARLIAMENT OF THE REPUBLIC OF GHANA
ENTITLED
THE PESTICIDES CONTROL AND MANAGEMENT
ACT, 1996

AN ACT to provide for the control, management and regulation of pesticides in Ghana and to provide for related matters.

DATE OF ASSENT: 23rd December 1996

BE IT ENACTED by Parliament as follows-

PART I – REGISTRATION OF PESTICIDES

1. No person shall import, export, manufacture, distribute, advertise, sell or use any pesticide in Ghana unless the pesticide has been registered by the Environmental Protection Agency in accordance with this Act. Requirement for registration of pesticides
2. (1) Notwithstanding section 1 of this Act, the Agency may authorise the importation of unregistered pesticide- Exceptions to section 1
- (a) if the pesticide is-
 - (i) imported for experimental or research purposes and not for distribution; or
 - (ii) imported in the event of national emergency; or
 - (iii) in direct transit through Ghana and the Agency is satisfied that the pesticide is permitted to enter the country of destination; or
 - (b) if the Minister by legislative instrument so prescribes.
- (2) The Agency may authorise the manufacture of unregistered pesticide for export if the pesticide is-
- (a) manufactured in accordance with specifications provided by the importer; and
 - (b) the specifications satisfy the requirements applicable for the purpose in the country to which it is to be exported.
3. A person seeking to register any pesticide shall submit to the Agency an application for registration which shall be in such form and be accompanied with such fee, information, samples and such other material as the Agency may determine. Application for registration of pesticides
4. (1) In registering a pesticide, the Agency shall classify it as being- Classification of pesticides
- (a) for general use;
 - (b) for restricted use;
 - (c) suspended; or
 - (d) a banned pesticide.
- (2) Pesticides classified under subsection (1) as restricted, suspended or banned shall be

subject to the Prior Informed Consent Procedure defined in section 41 of this Act.

- | | |
|--|---|
| <p>5. The Agency may classify a pesticide for general use if, having regard to the provisions in section 7 of this Act, it considers that the pesticide when applied for the use for which it is registered will not have an unreasonable adverse effect on the environment.</p> | <p>Pesticides for general use.</p> |
| <p>6. The Agency shall classify a pesticide as restricted or suspended if it considers that its use in accordance with widespread commonly recognised practice in the absence of additional regulatory restrictions may cause unreasonable adverse effect on people, animals, crops or on the environment.</p> | <p>Restricted and suspended pesticides</p> |
| <p>7. In determining whether or not to approve the registration of a pesticide and what classification to give a registered pesticide, the Agency shall consider relevant matters including-</p> <ul style="list-style-type: none"> (a) the characteristics of the pesticide formulation, such as the acute dermal, oral or inhalation toxicity; (b) the persistence, mobility and susceptibility to biological concentration of the pesticide; (c) the experience gained from the use of the pesticide, such as the likelihood of its misuse and any good safety record which is contrary to available laboratory toxicological information; (d) the relative hazards of its patterns of use, such as granular soil applications, ultra low volume or dust aerial applications or air blast sprayer applications; (e) the extent of the intended use; and (f) the supporting data and other technical information that the Agency may request from the applicant or from any public institution. | <p>Matters to be considered in registration and classification of pesticides.</p> |
| <p>8. The Agency may approve and register a pesticide subject to such other conditions as it may determine and may only register a pesticide if it is satisfied that the pesticide is safe and effective for the use for which it is intended and that the pesticide has been tested for efficacy and safety under local conditions.</p> | <p>Approval</p> |
| <p>9. (1) Where in respect of an application for registration of a pesticide, the Agency is satisfied that-</p> <ul style="list-style-type: none"> (a) most information required for its registration has been provided to the Agency, and (b) the pesticide does not present a toxicological risk to people, animals, crops or the environment, <p>It may clear the pesticide for use without the registration, and this clearance shall be known as provisional clearance and shall be temporary pending the registration by the Agency of the pesticide.</p> <ul style="list-style-type: none"> (2) Provisional clearance shall be given subject to such other conditions, as the Agency shall determine. (3) The Agency shall cancel the provisional clearance if the application for the registration of the pesticide is refused. | <p>Provisional Clearance</p> |
| <p>10. (1) A provisional clearance for any pesticide shall be valid for such period as the Agency may determine but shall not exceed 1 year.</p> <ul style="list-style-type: none"> (2) The Agency may require- | <p>Duration and renewal of provisional</p> |

- (a) the submission of such information; and clearance
- (b) the analysis of such samples as appear to it to be necessary to determine whether and under what conditions the provisional clearance shall be granted
- 11.** Where the Agency refuses to register any pesticide it shall inform the applicant in writing of the refusal and the grounds for the refusal within 14 days of the decision. Refusal to register pesticide
- 12.** (1) A pesticide registration shall remain valid for a period not exceeding 3 years from the date of registration. Duration of registration and renewal of registration
- (2) The Agency may, where it is satisfied that a registered pesticide remains safe and effective for use in Ghana, renew the registration for further periods of 3 years at a time,
- (3) The renewal of any pesticide registration shall be subject to-
- (a) submission of such information, analysis or samples as the Agency may require; and
- (b) such other conditions as the Agency shall determine.
- 13.** Information furnished by an applicant in respect of registration of a pesticide or its renewal, which is agreed to by the Agency, and the applicant as confidential shall not be disclosed by the Agency unless authorised by law. Non-disclosure of confidential information
- 14.** The Agency, if satisfied that a registered pesticide under the existing conditions of its registration or provisional clearance-
- (a) is not effective; or
- (b) may cause hazard or people, animals, crops or the environment,
- may by publication in the Gazette amend the classification, suspend or ban the pesticide or cancel the registration or provisional clearance at any time after the registration or during the period of provisional clearance. Power of Agency to amend, ban or suspend pesticides.
- 15.** (1) There shall be kept by the Agency a register to be known as the Register of Pesticides in which the Agency shall record the names and particulars of registered and provisionally cleared pesticides. Register of Pesticides
- (2) The contents of the Register of Pesticides shall be reviewed periodically by the Agency.
- 16.** The Agency shall cause to be published in the Gazette annually-
- (a) registered pesticides and their classification;
- (b) provisionally cleared pesticides;
- (c) suspended or banned pesticides; and
- (d) amendments made to the classification of pesticides
- Gazette publication

PART II – LICENSING OF PESTICIDES DEALERS

- 17.** (1) No person shall import, export, manufacture, distribute, advertise or sell any pesticide except in accordance with a licence issued under this Act. Requirement for licence to deal in pesticides
- (2) Any licence issued under this Act shall be subject to such conditions as may be specified in relation to it and to any other conditions as the Agency may from time to time prescribe for the licence.
- 18.** The Agency may by legislative instrument exempt from the requirement of a licence under section 17 such pesticides as shall be specified in the instrument. Exemptions
- 19.** An application to import, export, manufacture, distribute, advertise or sell pesticides shall be Application for

- made to the Agency in a form determined by the Agency and shall be accompanied with such fee and information, as the Agency shall determine. dealers licence
- 20.** The Agency may issue a licence authorising the applicant to import, export, manufacture, distribute, advertise or sell pesticides if it has reasonable grounds to believe that the applicant will comply with the conditions required under the licence. Issue of dealer's licence
- 21.** (1) No person shall use or require an employee to use a pesticide in any manner that is inconsistent with the provisions of this Act or regulations made under this Act. Safeguards for use of Pesticides
- (2) Any person concerned with the use of a pesticide shall inform any other person who uses a pesticide of the dangers involved in the misuse of pesticides.
- (3) Where regulations under this Act require that a pesticide be applied by or under supervision of a person authorised in that behalf by the Agency, no person shall apply that pesticide unless he is so authorised or supervised.
- (4) No person shall require or permit an employee to handle or use pesticides in the course of his employment without providing and requiring the employee to use such protective facilities and clothing as will permit safe handling of the pesticide
- (5) Where protective facilities and clothing are required as a condition for a licence, every employer whose employees use or handle pesticides to which the licence relates shall provide and require the use of the facilities and clothing.
- (6) No person shall knowingly harvest or offer for sale any foodstuff on which pesticides have been used except in compliance with practices including the interval between the application or pesticides and harvest as may be prescribed.
- 22.** The Agency may suspend or cancel a licence if- Suspension, cancellation of licence
- (a) it has reasonable grounds to believe that the licence has failed or refused to comply with this Act, regulations made under it or any other conditions for the licence or;
- (b) it considers that the action appears necessary to prevent or remove a hazard to people, crops, animals or the environment.
- 23.** (1) A person aggrieved by any suspension or cancellation of his licence who desires to appeal against it, shall appeal in the first instance to the Minister. Appeal
- (2) The Minister shall determine the matter within a period of thirty days after the receipt of written notification of the grievance.
- (3) If the grievance is not determined within the period by the Minister or if the person is dissatisfied with the decision of the Minister he may appeal to the High Court.
- 24.** The Agency may restrict or prohibit the use of a registered pesticide in designated areas during specified periods of time. General regulatory power
- 25.** (1) No person shall alter any pesticide so as to change its formulation, composition or usage or alter it in any other manner. Conformity to registered pesticides
- (2) No person shall sell a registered or provisionally cleared pesticide or an unregistered pesticide imported under section 2(1)(b) of this Act if because of –
- (a) fault in manufacture;
- (b) deterioration
- (c) accident or any other cause;
- the pesticide fails to meet the conditions of the registration or of the provisional clearance or the conditions of the authorisation.

- 26.** No person shall advertise any registered or provisionally cleared pesticide in a manner which-
- (a) is false;
 - (b) is misleading or inconsistent with the information supplied to the Agency at the time of the application; or
 - (c) omits warnings prescribed by the Agency.
- Advertising of registered pesticides
- 27.** (1) The Agency may prescribe the containers, labels and the manner for packaging of pesticides at the wholesale and retail levels.
- (2) Where any container, label or packaging has been prescribed by the Agency for a registered pesticide, no person shall-
- (a) manufacture, import, export, distribute, advertise or sell any registered pesticide otherwise than in a package or container prescribed for the pesticide; or
 - (b) alter the label of any pesticide so as to misrepresent the nature of the pesticide.
- Containers and packaging of pesticides
- 28.** Every person who imports, exports, manufactures, distributes or sells a pesticide shall make a record of the quantities of pesticides imported, exported, manufactured, distributed or sold by him and the record shall be-
- (a) maintained for 10 years from the time it is made; and
 - (b) made available to the Agency as its request at such time and in such manner as the Agency may require.
- Records and reporting
- 29.** (1) The powers and functions conferred on the Agency under this Act shall be exercised by the Board.
- (2) The Board may delegate any of its powers and functions under this Act to a committee of the Board, a member of the Board or any other person.
- Exercise of function by the Board
- 30.** (1) For the purposes of enabling the Board perform its functions under this Act, there is hereby established at the Agency a committee to be known as the Pesticides Technical Committee, which shall be a committee of the Board.
- (2) The Pesticides Technical Committee shall be composed of the following members-
- (a) a Chairman appointed by the Board;
 - (b) the Head of the Chemistry Department of the National Nuclear Research Institute of the Ghana Atomic Energy commission;
 - (c) a representative from the Cocoa Services Division of the Ghana Cocoa Board not below the rank of an executive director who shall have expertise in pesticides;
 - (d) the Director of the Plant Protection and Regulatory Services of the Ministry of Food and Agriculture;
 - (e) the Director of the Veterinary Services Department of the Ministry of Food and Agriculture
 - (f) a representative from the Ministry of health;
 - (g) a representative of the Ghana Standards Board not below the rank of a Senior Scientific Officer;
 - (h) a representative from the laboratory of the Customs, Excise and Preventive Service not below the rank of Principal Collector;
 - (i) a representative from the Association of Ghana Industries;
 - (j) a representative of the Ghana National Association of Farmers and Fishermen;
 - (k) a representative from the Ministry of Lands and Forestry;
- Pesticides Technical committee, its composition and functions

- (l) one representative from the Environmental Protection Agency not below the rank of a Senior Programme Officer who shall be the Secretary to the Committee; and
- (m) a representative of the Ministry responsible for the Environment.

(3) The Pesticides Technical Committee shall perform such functions under this Act relating to the control and management of pesticides as the Board may assign to it.

(4) The quorum for a meeting of the Committee shall be seven members.

(5) The Committee shall regulate its own procedure.

PART III – ENFORCEMENT AND PENALTIES

31. A member of the relevant sub-committee of a District Assembly so authorised or an inspector appointed under section 15 of the Environmental Protection Agency Act, 1994 (Act 490) may- Power of Inspector

- (a) inspect any equipment used or to be used in applying pesticides;
- (b) inspect any storage or disposal facilities or areas used for the storage or disposal of pesticides;
- (c) inspect any land actually, or reported to be, exposed to pesticides;
- (d) investigate complaints or injury to human beings and animals, or damage to land and pollution of water bodies resulting from the use of pesticides;
- (e) take samples of pesticides applied or to be applied;
- (f) monitor the sale and use of pesticides;
- (g) examine and take copies of a licence or other documents required by this Act or any regulations made under this Act.

(2) An inspector or a person authorised under subsection (1) may, if he has reasonable cause to believe that an offence has been committed under this Act or against any regulations made under this Act without warrant-

- (a) enter and search premises, other than premises used exclusively as a place of residence, in which he believes on reasonable grounds that the offence has been committed or that a pesticide which has been illegally used is being stored;
- (b) stop and search any vehicle which he believes is being used in the commission of the offence under this Act;
- (c) seize any equipment, pesticide or appliance which he believes on reasonable grounds is being used in the commission of the offence;
- (d) arrest any person who he believes on reasonable grounds has committed the offence.

(2) A written receipt shall, where reasonably practicable, be given for an article or thing seized pursuant to subsection (1) of this section, and the reasons for the seizure shall be stated in the receipt.

(3) A person arrested under subsection (1) of this section shall be taken before a court within 48 hours

(4) An inspector or a person authorised under subsection (1) of this section shall declare his office and produce evidence of his authority before he enters and searches any premises and in any other case produce it on request.

32. (1) Any sample of pesticide taken for the purpose of analysis shall be submitted to and analysed by an analyst appointed by the Agency. Analysis and Certificate

(2) In any proceedings under this Act, the production of a certificate signed by an analyst appointed by the Agency shall be prima facie evidence of the facts stated in it.

33. Any person who-

Obstruction of

- (a) willfully obstructs an inspector or an authorised person in the exercise of any power conferred on him under this Act or regulations made under this Act or inspectors.
- (b) fails to comply with a lawful enquiry or requirement made by an inspector or an authorised person in accordance with section 31 of this Act,

commits an offence and is liable on conviction to a fine not exceeding ₪500,000 or to imprisonment for a term not exceeding 6 months or to both.

34. (1) Any person who-

Other offences
and penalties

- (a) except as provided in section 2 or otherwise exempted, imports, exports, manufactures, distributes, advertises, sells or uses any pesticide which has not been registered contrary to section 1 of this Act; or
- (b) imports, exports, manufactures, distributes, advertises or sells any pesticides without a licence contrary to section 17 (1) of this Act; or
- (c) uses a pesticide or requires an employee to use a pesticide contrary to any provision in section 21 of this Act; or
- (d) alters any pesticide so as to change its formulation, composition or usage in any manner contrary to section 25(1); or
- (e) sells a registered or provisionally cleared pesticide which by reason of fault of manufacture, deterioration, accident or any other reason fails to meet the conditions required by this Act contrary to section 25(2); or
- (f) contravenes any requirements for the presentation of pesticides provided under section 27 (2) (a) or (b)

commits an offence and is liable on conviction to a fine not exceeding 5 million or to a term of imprisonment not exceeding 2 years or to both.

(2) In the case of a continuing offence, there shall be an additional fine not exceeding 500,000 in respect of each day on which the offence continues.

(3) Any person who-

- (a) advertises a pesticide in a manner which is false, misleading or inconsistent with the information supplied to the Agency at the time of registration; or
- (b) includes on the label or accompanying instructions of any pesticide misleading or fictitious claim, contrary to section 26 of this Act commits an offence and is liable on conviction to a fine not exceeding 2 million or to a term of imprisonment not exceeding 1 year and in the case of a continuing offence to an additional fine not exceeding 200,000 in respect of each day on which the offence continues.

(4) Any person who-

- (a) fails or refuses to maintain or submit the contents of records to be maintained; or
- (b) deliberately or negligently makes false records; or
- (c) submits false or misleading statements

commits an offence and is liable on conviction to a fine not exceeding 1 million or 6 months imprisonment; and in the case of a continuing offence, to an additional fine not exceeding 200,000 in respect of each day on which the offence continues.

(5) Any person who knowingly discloses, otherwise than as provided by this Act, any proprietary information acquired by him in the exercise of any duty under this Act commits an offence and is liable on conviction to a fine not exceeding 1 million or to a term of imprisonment not exceeding 6 months or to both.

36. It shall not be a defence for any person charged with the sale of a pesticide contrary to section 1 to plead that he had no reason to believe at the time of sale that the pesticides was not registered or differed in anyway from the purported contents of the container or that the Sale of pesticides

pesticide otherwise failed to meet the requirements of this Act.

- (1) Where an offence is committed by a body of persons-
- (a) in the case of a body corporate other than a partnership every director or officer of the body shall also be deemed guilty of the offence;
 - (b) in the case of a partnership every partner or officer of that body shall also be deemed to be guilty of that offence.
- (2) No person shall be guilty of an offence by virtue of subsection (1) if-
- (a) he proves that the offence was committed without his knowledge or connivance; and
 - (b) that he exercised due care and diligence to prevent the commission of the offence having regard to all the circumstances.

Offences by
body of persons

37. Where a person is convicted of an offence under this Act or any regulations made under this Act, the court may in addition to any other penalty imposed, order that any equipment, pesticide or appliance used in the commission of the offence shall be forfeited to the State and that a licence issued under this Act shall be suspended for such period as the court may direct or be cancelled.

Forfeiture

PART IV – GENERAL PROVISIONS

38. (1) Every customs officer shall-

- (a) assist in the enforcement of the provisions of this Act; and
- (b) prevent the importation into Ghana of any pesticide where the importation is contrary to this Act.

Customs Officer

(2) The Agency shall provide the Commissioner of Customs with a list of licensed importers and a list of registered and banned pesticides.

(3) The Commissioner of Customs shall keep records of imported pesticides and, shall at such regular periods as the Agency may direct, submit copies to the Agency.

39. (1) The Minister responsible for Environment on the recommendation of the Board and in consultation with the Minister responsible for Food and Agriculture, may by legislative instrument make such regulations as may be necessary for the purpose of giving full effect to the provisions of this Act.

Power to make
regulations

(2) Without prejudice to subsection (1) of this section, regulations may be made prescribing matters relating to-

- (a) the manufacture, importation, exportation, distribution and sale of pesticides;
- (b) the reporting of significant pesticide accidents or incidents to designated person or office and the procedure for such reporting
- (c) procedure for the storage, transportation and disposal of any pesticide or pesticide container which is considered likely to cause injury to human beings, vegetables, crops, livestock, wildlife or beneficial insects or which is likely to pollute the environment;
- (d) the form and contents of pesticide labels;
- (e) method of packaging of registered pesticides;
- (f) pesticides containers and their disposal;
- (g) the advertising of pesticides;
- (h) the purpose for which any pesticides may be used and the manner in which it may be used;
- (i) the licensing of premises where pesticides are used or dealt in;

- (j) practices, including pre-harvest intervals, for the harvest of crops and the slaughter and milking of animals following exposure to pesticides;
- (k) the application of pesticides that are to be made under the supervision of an authorised person and the provision for such authorisations;
- (l) the analyses of pesticides;
- (m) facilities and clothing to be used or worn while handling pesticides;
- (n) the disposal of pesticides;
- (o) records to be maintained by persons importing, manufacturing, formulating, distributing or selling pesticides;
- (p) aerial application of pesticides;
- (q) pesticide applicators;
- (r) the exemption of the importation of certain specified categories and quantities of pesticides from the requirement of a licence.

(3) Regulations made under this section may prescribe in relation to any contravention of any provision in it, penalties not exceeding a fine of 2 million or a term of imprisonment not exceeding 1 year or both for additional penalties not exceeding 200,000 for each day in respect of continuing offences.

40. (1) The Agency may for the registration of pesticides and licensing of dealers charge such fees as the Board shall determine. Fees

41. In this Act unless the context otherwise requires-

Interpretation

“advertising” means the promotion of the sale and use of pesticides by print or electronic media, signs, displays, gifts, demonstration or word of mouth;

“Agency” means the Environmental Protection Agency;

“banned pesticide” means a pesticide for which registered use has been prohibited by the Agency or for which registration has not been granted by the Agency for health and environmental reasons;

“Board” means the Environmental Protection Agency Board established under section 3 of the Environmental Protection Agency Act, 1994 (Act 490);

“Committee” means the Pesticides Technical Committee provided for under section 30;

“dealer” means any person who imports, exports, manufactures, distributes, advertises or sells pesticide;

“defoliant” means a substance or mixture of substances which when applied to a plant causes the leaves or foliage to drop from the plant with or without abscission;

“District Assembly” includes Municipal and Metropolitan Assembly;

“desiccant” means a substance or mixture of substances which when applied to a plant, accelerates the drying of the tissue of the plant;

“distribute” means to supply commercially, to transport, store or sell;

“formulation” means the combination of various ingredients designed to render the product useful and effective for the purpose claimed, or the form of pesticide as purchased by users;

“Inspector” means Environmental Protection Inspector appointed under section 15 of the Environmental Protection Agency Act, 1994 (Act 490) or person of the relevant sub-committee of a District Assembly authorised under section 31 (1) of this Act;

“label” includes any writing, printing or illustration made on, attached to, included in, belonging to or accompanying a pesticide or its container;

“manufacture” in relation to a pesticide means to do any of the following – prepare,

compound, make the active or other ingredients, to add substances, mix, formulate, package or re-package, label or otherwise treat the active ingredient with a view to its sale, but does not include the carrying on of bonafide research or experiment relating to a pesticide or doing of an act or thing that forms part of or is incidental to such research or experiment;

“Minister” means the Minister responsible for the Environment;

“pest” means any insect, rodent, bird, fish, mollusc, nematode, fungus, weed, micro-organism, virus or any other kind of plant or animal life that is injurious to human or animal health, crops, stored produce, processed foods, wood, cloths, fabrics or other inanimate objects;

“pesticide” means-

- (a) a substance or mixture of substances intended for preventing, destroying, repelling or reducing the destructive effects of any pest; or
- (b) a substance or mixture of substances intended for use as a plant regulator, defoliant, desiccant or wood preservative;

“plant regulator” means a substance or mixture of substances which, when applied to ornamental or crop plants or to their produce, causes, through physiological action, the acceleration or retardation of the rate of growth or otherwise alters the behaviour of those plants or their produce, but does not include substances intended for use as plant nutrients, trace elements, nutritional chemicals, plant inoculants or soil amelioration;

“prescribed” means prescribed by legislative instrument;

“Prior Informed Consent Procedure” means the international operation procedure for exchanging, receiving and handling notification information by the Agency on restricted, suspended and banned pesticides for reasons of health and the environment;

“sell” includes to offer for sale and to provide pesticide as part of a service of pest control notwithstanding that the pesticide is described as free or included in the service.

“unreasonable adverse effect on the environment” means any effect which is injurious to human, animal or plant life or which renders the environment unsafe for human, animal or plant life;

42. After 6 months from the coming into force of this Act, pesticides shall be registered in compliance with this Act and licences for dealing in pesticides shall be issued in compliance with this Act. Transitional provision

Date of *Gazette* notification: 31st December 1996

ANNEX III: DETAILS OF SUB-CATEGORIES OF SOURCES OF PCDD/PCDF IN GHANA

SUMMARY	2
INTRODUCTION	2
METHODOLOGY USED FOR PERFORMING INVENTORIES OF FURANS AND DIOXINS RELEASES IN GHANA	3
MAIN SOURCE CATEGORIES FOR PCDD/PCDF IN GHANA	3
PROCESS SUB-CATEGORIES THAT ARE CARRIED OUT IN GHANA	3
Municipal Waste Incineration- Sector 1a	3
Hazardous waste incineration- Sector 1b	4
Medical Waste incineration-Sector 1c.....	4
Light fraction Shredder Waste incineration –Section 1d.....	4
Sewage Sludge Incineration- Section 1e	4
Wood waste and biomass incineration- Sector 1f.....	4
Combustion of Animal carcasses-Sector- 1g.....	4
Iron and ore Sintering-Sector 2a.....	4
Coke Production-Section 2b	4
Iron and Steel Production Plants and foundries- Sector 2c	4
Copper Production- Sector 2d	4
Aluminum Production- Sector 2e	5
Lead Production-Sector 2f.....	5
Magnesium Production-Sector 2g	5
Other non-ferrous metal production-Sector 2h.....	5
Thermal Wire reclamation Sector 2i.....	5
Fossil Fuel Power Generation- Sector 3a	5
Biomass Power plants- Sector 3b	5
Landfill/Biogas Combustion- Sector 3c	5
Household Heating and cooking (biomass) – Sector 3d.....	5
Domestic Heating (fossil fuel) - Sector 3e	5
Cement Production- Section 4a	6
Lime Production – Section 4b	6
Brick Production – Section 4c	6
Glass Production – Section 4d.....	6
Ceramics Production – section 4e.....	6
Asphalt Mixing – Section 4f.....	6
4- Stroke Engines – Section 5a.....	6
2- Stroke Engines – Section 5b.....	6
Diesel Engines – Section 5c	6
Heavy Oil Fired Engines- 5d.....	7
Biomass Burning – 6a.....	7
Waste Burning and Accidental Fires – 6b	7
Pulp and Paper Mills – section 7a	7
Chemical Industry – Section 7b.....	7
Petroleum Industry – Section 7c.....	7
Textile Plants – section 7d.....	8
Leather Plants- Section 7e	8
Drying of Biomass – Section 8a.....	8
Crematoria- Section 8b.....	8
Smoke Houses- Section 8c	8
Dry Cleaning – Section 8d.....	8
Tobacco Smoking – Section 8e	8

Disposal/Landfills – Section 9a.....	8
Sewage and Sewage Treatment – Section 9b	8
Composting - Section 9c.....	8
Open water Dumping – Section 9d.....	8
Waste Oil Disposal (Non-Thermal) – section 9e.....	9
Production Sites for Chlorinated Organics – Section 10a	9
Production Sites of Chlorine – Section 10b.....	9
Formulation Sites for Chlorinated phenols – Section 10c	9
Timber Manufacture and treatment Sites. – Section 10d.....	9
PCB-Filled Transformers and capacitors- section 10e	9
INVENTORY OF PCDD/PCDFS IN GHANA.....	10
1. Waste Incineration.....	10
2. Ferrous and Non-Ferrous Metal Production	11
3. Power Generation and Heating.....	11
4. Mineral Production	12
5. Transport.....	12
6. Uncontrolled Combustion Processes	12
7. Production and Use of Chemicals and Consumer Goods.....	12
8. Miscellaneous	12
9. Disposal	13
10. Hot Spots	13
ASSESSMENT	13
Measures in Place to control Releases and Options for further Release Reductions.....	14
Main Data Gaps and their Perceived Importance	14
ANNEXES.....	14

SUMMARY

The potential main Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans PCDD/PCDF source categories present in Ghana has been identified. The emissions of Dioxins and Furans to air water and residues for seven sectors are summarized in Table 2. The inventory estimates are based on measurements available in Ghana and on emission factors from international literature. Uncontrolled burning in waste dumps, medical incineration and Power Generation/Heating are the main sources of PCDD/PCDF in Ghana, for which also the most reliable data are available. A total of 37.852 g I-TEQ of PCDD/PCDF was emitted from known sources in the year 2002. The sector of uncontrolled burning in waste dumps emits a total of 24.191 g I-TEQ to air corresponding to 64% of the total emissions. Most of the emissions (93%) are to air.

INTRODUCTION

Persistent Organic Pollutants (POPs) are highly stable compounds used either as pesticides or in industry. They are also generated unintentionally as the by products of combustion and industrial processes.

The Stockholm Convention, which was adopted on 23 May 2001, with the objective to protect human health and the environment from POPs focuses on reducing and eliminating releases of 12 of the most dangerous POPs. These “Dirty Dozen” include eight pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene), two industrial chemicals (polychlorinated biphenyls (PCBs) and Hexachlorobenzene), and three bi-products (polychlorinated dibenzo-p-dioxins and dibenzofurans), Hexachlorobenzene.

Dioxins and Furans

Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD-PCDF) are environmental contaminants detectable in almost all compartments of the global ecosystem in trace amounts. They have

never been produced intentionally and have never served any useful purpose unlike other POPs like DDT. They are formed as an unwanted by-product in many industrial and combustion processes. Consequently, it is impossible to eliminate dioxins and furans by prohibition of production and use. Dioxins and Furans like all POPs are persistent, do bio-accumulate, and pose risk of causing adverse effects on humans and the environment. They can be transported long distances and have been detected in the furthest corners of the globe. Indirect measures have to be taken to reduce the emissions of PCDD/PCDF into the environment and to minimize human exposure. These require that sources of PCDD/PCDF are identified and quantified.

METHODOLOGY USED FOR PERFORMING INVENTORIES OF FURANS AND DIOXINS RELEASES IN GHANA

The Standardized Toolkit for Identification and Quantification of Dioxins and Furans releases developed by UNEP Chemicals was used. The following are the five steps making up the Toolkit: (Standardized Toolkit for Identification and Quantification of Dioxins and Furans releases UNEP Chemicals Draft 2001)

- Step 1: Applying Screening Matrix to identify main source categories.
- Step 2: Checking subcategories to identify existing activities and sources in the Country.
- Step 3: Gathering detailed information on the process and classifying processes into similar groups applying a Questionnaire.
- Step 4: Quantifying identified sources with default/measured emission factors.
- Step 5: Applying nation-wide to establish full inventory and reporting using guidance provided.

MAIN SOURCE CATEGORIES FOR PCDD/PCDF IN GHANA

The potential main source categories for Dioxin and Furan releases in Ghana are summarized in Table 1 below.

Table 1: Potential Main source categories

No	Main Source Categories
1	Waste Incineration
2	Ferrous and Non-Ferrous Metal Production
3	Power Generation and Heating
4	Mineral Production
5	Transport
6	Uncontrolled combustion Processes
7	Production and Use of Chemicals and consumer Goods
8	Miscellaneous
9	Disposal
10	Hot Spots

PROCESS SUB-CATEGORIES THAT ARE CARRIED OUT IN GHANA

Municipal Waste Incineration- Sector 1a

There are no facilities in the country to incinerate municipal wastes.

Hazardous waste incineration- Sector 1b

No hazardous waste incineration is undertaken in this country.

Medical Waste incineration-Sector 1c

Statistics available indicates that the Korle-Bu and Komfo Anokye Teaching hospitals (KATH) are both using the same simple batch-type incinerators

Weekly quantities incinerated at KorleBu Teaching Hospital= 1500kg

Annual Medical waste burned = $1500 \times 52 = 78$ tonnes

Default Emission factor (air) for Uncontrolled batch type combustion, no APC = $40,000 \mu\text{g TEQ/t}$

Potential emission into the air using default emission factor = $40,000 \times 78 = 3.12 \text{ g} \dots(a)$

Default emission factor (residues) for uncontrolled batch type combustion, no APC $200 \mu\text{g TEQ/t}$

Potential emission in residue using default emission factor = $200 \times 0.078 = 3.9 \mu\text{g}$

Weekly rate of incineration at KATH in Kumasi = 750g

Annual incineration rate at KATH at Kumasi = $750 \times 52 = 39$ tonnes

Potential emission in air using default factor of = $40,000 \times 39 = 1.56 \text{ g}$

Default emission factor (residues) for uncontrolled batch type combustion, no APC $200 \mu\text{g TEQ/t}$

Potential emission in residue using default emission factor = $200 \times 0.039 = 1.95 \mu\text{g}$

Total annual emission to air

Light fraction Shredder Waste incineration –Section 1d

No Light fraction shredder waste incineration is undertaken in Ghana.

Sewage Sludge Incineration- Section 1e

Ghana does not undertake sewage sludge incineration.

Wood waste and biomass incineration- Sector 1f

No incineration of wood waste and biomass is undertaken in Ghana.

Combustion of Animal carcasses-Sector- 1g

No incineration of animal carcasses takes place in Ghana.

Iron and ore Sintering-Sector 2a

There is no iron ore and iron ore sintering in Ghana.

Coke Production-Section 2b

Coke is not produced in Ghana.

Iron and Steel Production Plants and foundries- Sector 2c

Annual steel production from scraps at Tema Steelworks = 36,000 tons

Annual steel production from scraps at Ferro-Fabrik = 30,000 tons

Annual steel production from scraps at Wahome = 50,000 tons

Total annual steel production from scraps in Ghana = 116,000 tons

Default Emission Factor in air for dirty scrap = $10 \mu\text{g-TEQ/t}$

Potential emissions in air at in Ghana using default emission factor = $116,000 \times 10 = 1.16\text{g}$

Default emission factor for release in residues = $15 \mu\text{g-TEQ/t}$

Potential emissions in residues in Ghana = $116,000 \times 15 = 1.74\text{g}$

Copper Production- Sector 2d

Copper is not produced in Ghana.

Aluminum Production- Sector 2e

Volta Aluminum Company (VALCO) at Tema is involved in primary aluminum production. There is presently no secondary aluminum production involving the thermal recycling of used aluminum in Ghana.

Lead Production-Sector 2f

Lead is not produced in Ghana.

Magnesium Production-Sector 2g

Magnesium is not produced in Ghana.

Other non-ferrous metal production-Sector 2h

There is no production of other non-ferrous metals in the country.

Thermal Wire reclamation Sector 2i

No thermal wire reclamation is undertaken in Ghana.

Fossil Fuel Power Generation- Sector 3a

Available statistics indicates the following:

At the Aboadze thermal Plant, 5.2 million barrels of light oil is burnt per year

Conversion rate: 1 barrel = 159 liters

Annual consumption of light oil = 159×5.2 million liters = 826.8 million liters

Conversion rate: 1L = 8.5×10^{-4} tons

Annual consumption of light oil = $8.5 \times 10^{-4} \times 826.8 \times 10^6$ tons = 702,780 tons = 702,780,000kg

Conversion rate for light oil: 1Kg = 46 MJ

Annual heating value = $702,780,000 \times 46 = 32.33$ Tj

Default emission factor for light fuel oil into air = 0.5 μ g/TJ

Potential emission in air at Aboadze Thermal Plant using default factor = $0.5 \times 32 = 16\mu$ g

Biomass Power plants- Sector 3b

Statistics on biomass power plants in Ghana is not available.

Landfill/Biogas Combustion- Sector 3c

Land fill/Biogas combustion is not undertaken in Ghana.

Household Heating and cooking (biomass) – Sector 3d

Wood fuel is the bulk of energy consumed mainly for household cooking and water heating in the residential and commercial sector.

Supporting information:

National Wood fuel consumption = 17,541.8 GWh/yr (Appendix 1)

Conversion rate: 1GWh= 3600 GJ

National consumption = $17,541.8 \times 3600 = 63150.48$ TJ

Default Emission factor virgin wood/biomass fired= 100 μ g-TEQ/TJ of Biomass Burned in air

Potential emission using default factors = 6.3g

Residue in water using emission factor of 20 μ g-TEQ/TJ = $20 \times 63150.48 = 1.3$ g

Domestic Heating (fossil fuel) - Sector 3e

Available statistics

Annual consumption of LPG in Ghana = 51,119 tons (Appendix 2)

Default emission factor in air = 1.5 μ g TER/t

Potential emission in air using default emission factor =
 $1.5 \times 51,119 = 0.076\text{g I TEQ}$

Cement Production- Section 4a

Ghana currently has two cement factories; one at Tema in the Greater Accra Region and the other at Takoradi in the Western Region.

The production process however involves the grinding and mixing of limestone, clinker and Gypsum .

Lime Production – Section 4b

Limited amounts of lime are produced in Ghana occasionally.

Brick Production – Section 4c

Brick is produced on very limited scale in Ghana. Data is not available.

Glass Production – Section 4d

The Aboso Glass factory in the Western Region is no longer operational

Ceramics Production – section 4e

Statistics gave the following data for 2002

Annual production of ceramics = 1,100 tons

Default emission factor – $0.2\mu\text{g TEQ/t}$

Potential emission in air using default factor = $1,100 \times 0.2 = 0.00022\text{g}$

Asphalt Mixing – Section 4f

Available statistics gave the following information:

Asphalt mixing is done on demand

14,000 tons produced in 2002 using a mixing plant with gas cleaning

Default emission factor for release in air: $0.007 \mu\text{g TEQ/t}$

Potential emission in air using default factor = $0.007 \mu\text{g TEQ} \times 14,000 = 0.000098\text{g TEQ}$

Default emission factor for release in residue= $0.06 \mu\text{g TEQ/t}$

Potential emission in residue using default emission factor = $0.06 \mu\text{g TEQ} \times 14,000 = 0.00084\text{g I-TEQ}$

4- Stroke Engines – Section 5a

Leaded petrol is used in Ghana.

Statistics gave the following Data: (Appendix 2)

567,493 tons of petrol was used in 2002.

Assumption 95% fuel consumed by 4-stroke engines = $0.95 \times 567,493 = 539,118$ tons

Default Emission factor range = $2.2- \mu\text{g TEQ/t}$ of leaded fuel burned

Potential emission using default factor = $539,118 \times 2.2 = 1.186\text{g}$

2- Stroke Engines – Section 5b

Annual consumption of petrol = 567,493 tons (Appendix 2)

Assumption: 5% of fuel used by 2-Stroke Engines = $0.05 \times 567,493 = 28,374.7$ tons

Default Emission factor range = $3.5- \mu\text{g TEQ/t}$ of leaded fuel burned

Potential emission using default factor = $3.5 \times 28,374.7 = 0.099\text{g}$

Diesel Engines – Section 5c

Statistics gave the following data for 2002: (Appendix 2)

Annual consumption of Diesel = 777,076 tons

Default Emission factor range = $0.5- \mu\text{g TEQ/t}$ of Diesel burned

Potential emission in air using default factor = $0.1 \times 777,075 = 0.078\text{g}$

Heavy Oil Fired Engines- 5d

Available statistics = 1,669 (Appendix 2)

Default Emission factor = 4- $\mu\text{g TEQ/t}$

Potential emission using emission factor = $4 \times 1,669 = 0.007\text{g}$

Biomass Burning – 6a

Available data covers the period 1995-96 and it is assumed that the situation has not improved or worsened. Details of estimation of vegetation destroyed by bushfire for the period under review is presented in Appendix 5:

Total vegetation destroyed in the forest zone = 4573283 ha

Assumption that forest vegetation is similar to Philippines within same ecological zone, conversion rate of 43 tons/ha is used.

Tonnage destroyed per year in forest zone = $43 \times 4573283 = 196655169$ tons

Total vegetation destroyed in Savannah zones = 5724830 ha

Assumption: Grassland conversion rate of 2.5 tons/ha

Tonnage vegetation destroyed in savannah zones = $2.5 \times 5724830 = 14312075$ tons

Total vegetation destroyed in Transitional Zones: 1186710

Assumption : Average of forest and Savannah zone = 23 tonnes /ha

Total tonnage destroyed = $23 \times 14312075 = 27294330$

Total vegetation destroyed nationwide by bushfire = 238261574 tonnes

Waste Burning and Accidental Fires – 6b

(i) Landfill fires:

Estimates for landfill fires is based on the following data:

Per capita waste generation = 0.5Kg/person per day (based on national survey data)

Proportion of waste burnt = 0.2 for the dry part of the country, and 0.03 for the wet parts of the country.

Using the above assumptions, annual wastes generated countrywide has been estimated in appendix 3 as = 24,191 tons

Using default emission factor of 1000 $\mu\text{g TEQ/t}$ of material burnt,

Potential emission to air using default emission factor = $1000 \times 24,191 = 24.191\text{g}$

(ii) Data on accidental fires in houses, factories is not available.

(iii) – (v) Data is not available on uncontrolled domestic waste burning, accidental fires in vehicles, and open burning of wood.

Pulp and Paper Mills – section 7a

There is no Pulp and Paper Mill in the country.

Chemical Industry – Section 7b

There are no chemical industries in Ghana producing Chlorophenols, halogenated organics chlorine production etc.

Petroleum Industry – Section 7c

Statistics gave the following information:

208 liters of heavy oil subjected to catalytic cracking per month.

No emission factor available due to lack of data.

Textile Plants – section 7d

Data obtained from the three main textile factories in the country indicates that no chlorinated dyes are used.

Leather Plants- Section 7e

There are no Leather plants in the country.

Drying of Biomass – Section 8a

Biomass – wood chips, sawdust etc are dried in the sun without the use of any fuel.

Emission due to the burning of wood or treated wood is thus not expected.

Crematoria- Section 8b

Statistics gave the following information:

360 cremations undertaken nationwide in 2002 with no control

Default emission factors: 90 µg TEQ/cremation

Potential emission in air = $360 \times 90 = 0.032\text{g}$

Smoke Houses- Section 8c

Smoking of fish, and meat is a common practice in Ghana. These are small installations where combustion conditions involve virgin (untreated) wood. hence minimal potential for dioxin formation.

Dry Cleaning – Section 8d

Statistics from the dry cleaning industry in Ghana is very limited to be of any use.

Tobacco Smoking – Section 8e

Statistics gave the following information

(a) Average annual production of cigarettes by local manufacturers (1999-2002) = 1,400,000,000 pieces

(b) Average annual import of cigarettes for local consumption (1999—2002)= 185,000,000

Assuming that all these are consumed locally

Total annual consumption of cigarettes = a + b = 1,585,000,000 (1.585 billion) pieces of cigarettes

Default Emission factor = 0.1pg/cigarette or 1.0×10^{-13}

Potential emission in air using default factor = $1.585 \times 10^9 \times 1.0 \times 10^{-13} = 1.585 \times 10^{-4} \text{g} = 0.00016\text{g}$

Disposal/Landfills – Section 9a

Statistics on leachate or seepage from waste dumps are not available in the country.

Sewage and Sewage Treatment – Section 9b

Wastewater arising from human sanitation and households is not well coordinated septic tanks are used in most residential and industrial concerns and statistics are thus not available.

Composting - Section 9c

Composting is undertaken in the country in an uncoordinated manner and statistics are not available.

Open water Dumping – Section 9d

Statistics gave the following information:

A. Inflow into the Chemu lagoon = $47,273 \text{ m}^3 / \text{day}$

B. Inflow into the Akosombo lake from Akosombo Textiles limited (ATL) = $60,000 \text{ m}^3$ per month

Inflow into Chemu Lagoon = $47,273 \text{ m}^3 / \text{day}$

Conversion rate $0.0038 \text{ m}^3 = 1\text{Gal} = 5 \text{ Liters}$

Total inflow into lagoon = $47,273 \times 5 / 0.0038 \text{ liters} = 62.2\text{million L/day}$

Total annual inflows into Chemu lagoon= $62.2 \times 10^6 \times 365 = 22.8 \times 10^9 \text{ L}$

Default emission factor in water for mixed urban waste water = 5 pg TEQ/L

Potential emission into Chemu lagoon using default factors = $5 \times 22.8 \times 10^9 \times 10^{-12} = 0.114\text{g}$

B. Inflow into Volta lake from ATL = $60,000 \text{ m}^3 / \text{month} = 60,000 \times 12 = 720,000 \text{ m}^3 / \text{yr}$

Conversion rate $0.0038 \text{ m}^3 = 1 \text{Gal} = 5 \text{ Liters}$

Total annual inflows into Akosombo lake = $720,000 \times 5 / 0.0038 = 9.5 \times 10^8 \text{ L}$

Default emission factor in water for mixed urban waste water = 50 pg TEQ/L

Potential emission into Volta lake from ATL using default factors = $50 \times 9.5 \times 10^9 \times 10^{-12} = 0.005\text{g}$

Waste Oil Disposal (Non-Thermal) – section 9e

Statistics gave the following data for 2002. (Appendix 4 & 5)

Total Waste oil produced annually in Ghana in 2002 = 26161 tons.

Assumption 30% waste oil subjected to combustion by industry.

Waste oils burnt per year = 20% of 26161 = 5232 tons

Default emission factor in air = $4 \mu\text{g TEQ/t}$

Potential emission using default factor = $5 \times 5232 = 0.026\text{g}$

Production Sites for Chlorinated Organics – Section 10a

Chlorinated Organics are not produced in Ghana.

Production Sites of Chlorine – Section 10b

There are no chlorine production sites in Ghana.

Formulation Sites for Chlorinated phenols – Section 10c

There are no sites for formulating Chlorinated phenols in the country.

Timber Manufacture and treatment Sites. – Section 10d

Statistics provided the following information:

No PCP or chlorinated chemicals are being used in the industry.

PCB-Filled Transformers and capacitors- section 10e

Information gathering is in progress.

Table 2: Summary of Potential PCDD/PCDF Emission in Ghana. Fluxes in *g I-TEQ/a
(Reference year 2002)

Source Category	AIR	WATER	RESIDUE	Total Emissions
Waste incineration Medical waste incineration	4.680	-	-	4.680
Ferrous and Non-Ferrous metal production Iron and steel Production plants and foundries	1.160		1.74	2.90
Power Generation and Heating Household Heating (biomass) Domestic heating (fossil fuel)	6.315 0.077	- -	1.3 -	7.692
Mineral Production Asphalt mixing	0.001		0.001	0.002
Transport 4-Stroke Engines 2-stroke engine Diesel engines Heavy oil engines	1.186 0.099 0.078 0.007			1.370
Uncontrolled Combustion Processes	24.191			24.191
Miscellaneous Crematoria	0.032			0.032
Disposal Open water dumping (Chemu lagoon) Open water dumping (Volta lake) Waste oil Disposal		0.114 0.005		0.119
TOTAL	37.852	0.119	3.041	41.012

*To 3 decimal places

INVENTORY OF PCDD/PCDFS IN GHANA

The results of the inventory if Dioxins/Furans emissions is presented in Table 3 below

Table 3 Inventory of PCDD/PCDFs in Ghana

Category	Activity/Process	Activity statistics t/yr	Default Emission Factor range (µg TER/t)	Potential emissions using default factors (g TEQ/a)	Country Data	Comment
1. Waste Incineration						
1a	Municipal waste incineration	0	N/A	0	0	No Municipal waste incineration
1b	Hazardous Waste incineration	0	N/A	0	0	No Hazardous waste incineration
1c	Medical Waste Incineration	117 117	40,000 200	4.68g 0.006	0 0	Emission in air Emission in

						residue
1d	Light Fraction Shredder incineration	0	N/A	0	0	No Light fraction incineration
1e	Sewage sludge incineration	0	N/A	0	0	No sewage sludge incineration
1f	Wood waste & biomass incineration	0	N/A	0	0	No Wood waste & biomass incineration
1g	Combustion of animal carcasses	0	N/A	0	0	No combustion of animal carcasses

2. Ferrous and Non-Ferrous Metal Production

2a	Iron and ore sintering	0	N/A	0	0	No iron and ore sintering
2b	Coke Production	0	N/A	0	0	No coke production i
2c	Iron and steel Plants	116,000	10 15	1.16 1.74	0 0	Emission in air Emission in residue
2d	Copper Production	0	N/A	0	0	No copper production
2e	Secondary Aluminum Production	0	N/A	0	0	No secondary Aluminum production
2f	Lead Production	0	N/A	0	0	No Lead production
2g	Magnesium production	0	N/A	0	0	No magnesium production
2h	Other non-ferrous metal production	0	N/A	0	0	No non-ferrous metal production
2i	Thermal wire reclamation	0	N/A	0	0	No thermal wire reclamation

3. Power Generation and Heating

3a	Fossil fuel power generation	702,780	0.5µg/ Tj	0.00002	0	Emission in air
3b	Biomass power plant	0	N/A	0	0	No Biomass power plant
3c	Landfill biomass combustion	0	N/A	0	0	No Biomass combustion
3d	House hold Heating	17,541.8	100µg			

	and Cooking	GWh/yr or 63150.48T J	TEQ/Tj	6.3 1.3		Emission in air Emission in residue
3e	Domestic Heating (fossil fuel)-LPG	51,119	1.5	0.076	0	Emission in air
4. Mineral Production						
4a	Cement Production	0	N/A	0	0	No cement production
4b	Lime Production	0	N/A	0	0	Very insignificant lime production
4c	Brick Production	0	N/A	0	0	Very insignificant lime production
4d	Glass Production	0	N/A	0	0	No Glass Production
4e	Ceramic Production	1,100	0.2	0.00022	0	Limited production
4f	Asphalt mixing	14,000	0.007 0.06	0.000098 0.00084	0	Emission in air Emission in residue
5. Transport						
5a	4-Stroke engine	567,793	2.2	1.19	0	Emission in air
5b	2-Stroke engine	28,374.7	3.5	0.1	0	Emission in air
5c	Diesel engine	777,076	0.5	0.39	0	Emission in air
5d	Heavy-fired oil engines	1,669	4	0.0067	0	Emission in air
6. Uncontrolled Combustion Processes						
6a	Biomass Burning					
6b	Waste burning & accidental fires	0	N/A	0	0	Information not available
7. Production and Use of Chemicals and Consumer Goods						
7a	Pulp and Paper Mills	0	N/A	0	0	No Pulp & paper Mills
7b	Chemical Industry	0	N/A	0	0	No Chemical industries
7c	Petroleum Industry	ND	ND	ND	ND	Lack of data
7d	Textile Plants	0	N/A	0	0	Textile Plants do not use chlorinated dyes
7e	Leather Plants	0	N/A	0	0	No leather plants
8. Miscellaneous						
8a	Drying of Biomass	0	N/A	0	0	No drying of Biomass
8b	Crematoria	360	90	0.032	0	Emission in air

8c	Smoke Houses					
8d	Dry cleaning	0	0	0	0	Limited information
8e	Tobacco smoking	1.585 billion pieces/yr	0.0001	0.00016	0	Emission in air
9. Disposal						
9a	Disposal/landfills					
9b	Sewage & sewage Treatment	0	0	0	0	
9c	Composting	0	0	0	0	Data not properly coordinated
9d	Open water dumping	62.2million liters/day	5	0.15	0	Emission into Chemu lagoon
9d	Open water dumping	720,000 m /yr	50 pg I-TEQ	0.48		Emission into Volta lake
9e	Waste oil disposal	5232 tons/yr	4	0.021	0	
10. Hot Spots						
10a	Production sites for chlorinated organics	0	0	0	0	Chlorinated organics not produced in Ghana
10b	Production sites for chlorine	0	0	0	0	No such sites in Ghana
10c	Formulation sites for production of Phenols	0	0	0	0	No such sites exist in Ghana
10d	Timber manufacture and treatment sites	0	0	0	0	Sites do not use chlorinated chemicals
10e	PCB-filled transformers					

ASSESSMENT

The emissions of dioxins and furans to air, water and residue for seven sectors are presented in Table 1. Major sources of emissions are summarized in Table 2. The inventory estimates are based on measurements available in Ghana and on emission factors from international literature (1). Ferrous and Non-ferrous metal production power generation/heating and Transport are the main sources of PCDD/PCDF in Ghana, for which also the most reliable data are available. A total of 12.96 g I-TEQ of PCDD/PCDF was emitted from known sources in 2002. The sector of power generation and heating emitted a total of 7.67 g I-TEQ to air and residue corresponding to 59% of the total emissions. Most of the emissions, 9.282 g I-TEQ/a or 72% are to air, and is the result of emission from iron and steel production plants and foundries (9%); household heating (biomass) (48.6%); and transport (13%). Release to residue constitute 23.5% (i.e. 3.04 g I-TEQ/a) of the total release and mainly the result of emissions from iron and steel production plants and foundries and household heating (biomass).

Measures in Place to control Releases and Options for further Release Reductions

Release of dioxins and furans to air and residue due to emissions from household heating (biomass) is currently being addressed indirectly through the promotion of a variety of gas fired stoves and ovens. to meet the cooking and heating needs of the populace. The focus of these promotions is more towards checking deforestation through reduction in the use of fuel wood than the implementation of the Stockholm Convention. Awareness raising on the harmful effects of dioxins and furans will precipitate public pressure for appropriate policy formulation on the need to reduce/eliminate PCDD/PCDFs.

Options for reduction in releases to air due to emissions from transport include the substitution of unleaded fuel for use in automobiles. as well as the formulation of the appropriate policies.

Main Data Gaps and their Perceived Importance

Disposal/landfills:

The management of municipal waste in Ghana is evident from the numerous waste dumps dotted all over the country. Available statistics indicate that a total of 2,777.5 tons of waste is generated annually in Ghana (Annex.). However, statistics on leachate and seepage from such waste dumps are not available, making it impossible to estimate emissions from waste dumps into water bodies. Considering the high annual rainfall in several areas in Ghana, measures must be put in place in the districts to collate data on seepage and leachate to facilitate estimation of releases into the country's water bodies.

Open water Dumping is another source of potential release of PCDD/PCDFs into the country's water bodies. Data on effluent emissions from industries, which are sited near main water bodies are not available making it impossible to estimate releases from such sources. Strict enforcement of monitoring policies by the Environmental Protection Agency (EPA) of Ghana will compel industry to provide the relevant data for future measurements.

Future Environmental Impact Assessment (EIA) of new industries in Ghana should take into consideration, the potential of some industrial activities becoming a source of Dioxins and Furans emissions.

ANNEXES

Annex.: Estimates of annual waste oil (non-thermal) burnt in Ghana annually

It is very difficult to obtain activity data for waste oil collected in the country. Whilst a substantial amount collected in the urban areas is processed and/or recycled, it is being assumed that the illegal part that may have a big share of the total is not known. Some waste oil is used as weed killers. Some are also blended with creosote and used as wood preservative, whilst others are used as alternate fuel e.g. brick and ceramic works. The proportion of this remaining part that may be combusted is not known. Release into air cannot therefore be calculated. Additionally, the non availability of emission factors has hindered the calculation of releases into water, land and product.

No. of private motor vehicles up to 2000 cubic capacity in 2002 = 265,517

Oil released per change = 5 liters

Total Waste Oil released per change = $265,517 \times 5$ liters = 1,327,585 liters

Assumption: 3 oil changes per year

Total oil released per year = 3,982,755 Liters

Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total amount of oil released by commercial vehicles up to 2000cc = $3,982,755 \times 9.7 \times 10^{-4} = 3,863$ tons...(a)

No of commercial motor vehicles up to 2000 cubic capacity in 2002 = 78, 466

Oil consumed per change per vehicle = 5 liters

Total Waste Oil released per change = $78,466 \times 5$ liters = 392330 liters

Assumption: 4 oil changes per year

Total oil released per year = $392330 \times 4 = 1569320$ liters

Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total amount of oil released by private vehicles up to 2000cc = $1.569 \times 10^6 \times 9.7 \times 10^{-4} = 1,522$ tons. (b)

No of private motor vehicles above 2000 cc in 2002 = 25,111

Oil Consumed per change = 10Liters

Total oil consumed per change of private vehicles >2000cc = 251,110 liters

Assumption: 3 changes per year

Total oil released per year = $251,110 \times 3 = 753,330$ liters

Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total amount of oil released per year by private vehicles up to 2000cc = $7.53 \times 10^5 \times 9.7 \times 10^{-4} = 730$ tons

©

No of buses and coaches = 94,030

Oil consumed per change = 25 Liters

Total oil released by buses and coaches per change = $94,030 \times 25 = 2,350,705$ L

Assumption: 4 changes per year

Total oil releases per year = $4 \times 2,350,705 = 9,403,000$ L

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil released by all buses and coaches per year = $9.4 \times 10^6 \times 9.7 \times 10^{-4}$ tons

Total oil discharged by all buses and coaches per year = 9,118 tons.....(d)

No of Rigid Cargo trucks up to 16 tons = 32,027

Oil discharged per change = 30 Liters

Total oil discharged per change = $30 \times 32,027 = 960810$ L

Assumption 5 changes per year

Total oil discharged per year = $5 \times 960810 = 4,804,050$ L

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged by Rigid cargo trucks up to 16 tons = $9.7 \times 10^{-4} \times 4804050 = 4,660$ tons (e)

No of Rigid Cargo trucks between 16 – 22 tons = 10,298

Oil consumed per change = 30 Liters

Total oil discharged per change = $30 \times 10,298 = 308940$ L

Assumption 6 oil changes per year

Total oil discharged per year = $6 \times 308940 = 1853640$ L

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged per year = $9.7 \times 10^{-4} \times 185 = 1,795$ tons (f)

No of Rigid Cargo trucks above 22 tons = 3,717

Oil consumed per change = 30 Liters

Total oil discharged per change = $30 \times 3,717 = 111510$ L

Assumption 8 changes per year

Total oil discharged per year = $8 \times 111510 = 892080$ L

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged per year = $9.7 \times 10^{-4} \times 892080 = 865$ tons (g)

Articulator Trucks up to 24 tons = 4,446

No of oil consumed per change = 40liters

Total oil discharged per change = $40 \times 4446 = 177840$ L

Assumption 8 changes per year

Total oil discharged per year = $8 \times 177840 = 1422720\text{L}$

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged per year = $9.7 \times 10^{-4} \times 1422720 = 1380$ tons (h)

Articulator Trucks between 24-32 tons = 3,334

Oil consumed per change = 40 liters

Total oil discharged per change = $40 \times 3334 = 133360\text{L}$

Assumption 10 changes per year

Total oil discharged per year = $10 \times 133360 = 1333600\text{L}$

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged per year = $9.7 \times 10^{-4} \times 1333600 = 1293$ tons (i)

Articulator trucks above 32 tons = 2,187

Oil consumed per change = 40 liters

Total oil discharged per change = $40 \times 2187 = 87480\text{L}$

Assumption 10 changes per year

Total oil discharged per year = $10 \times 87480 = 874800\text{L}$

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged per year = $9.7 \times 10^{-4} \times 874800 = 848$ tons (j)

No of agricultural equipment= 1,796

Average oil consumed per change: 25 liters

Total oil discharged per change = $25 \times 1796 = 44900\text{L}$

Assumption 2 changes per year

Total oil discharged per year = $2 \times 44900 = 89800\text{L}$

Using Conversion factor for 1L of oil = 9.7×10^{-4} tons

Total oil discharged per year = $9.7 \times 10^{-4} \times 89800 = 87$ tons (k)

Total Waste oil produced annually in Ghana in 2002 = a+ b+ c+.....+I + j+ k =
 $3863+1522+730+9118+4660+1795+865+1380+1293+848+87 = 26161$ tons

ANNEX IV

FINAL DRAFT

**ENVIRONMENTAL PROTECTION AGENCY
(GHANA)**

NATIONAL ENVIRONMENTAL QUALITY STANDARDS REGULATIONS, 2000

Prepared by EPA

TABLE OF CONTENTS

	Page No
1. Standards for Ambient Air Quality	3
2. Standards for Noise Quality	9
3. General Effluent Limitations for Industry	13
4. Effluent Limitations for the Textile Industry	17
5. Effluent Limitations for the Food and Beverages Industry	20
6. Effluent Limitations for the Paints and Chemicals Industry	23
7. Effluent Limitations for the Pharmaceuticals Industry	26
8. Effluent Limitations for the Paper and Pulp Industry	29
9. Effluent Limitations for the Hotels and Resorts Industry	32
10. Effluent Limitations for the Wood and Wood Processing Industry	35
11. Effluent Limitations for the Cement, Ceramics and Tiles Industry	38
12. Effluent Limitations for the Thermal Power Plant Industry	41
13. Effluent Limitations for the Glass Industry	44
14. Effluent Limitations for the Hospitals and Clinics Industry	47
15. Effluent Limitations for the Oil and Gas Exploration, Production and Refining Industry	50
16. Effluent Limitations for the Mining and Mineral Processing	53
17. Effluent Limitations for the Metal Industry	56
18. Application for Industrial effluent discharge permit	59
19. Effluent Limitations for Effluent Treatment Plants	

STANDARDS FOR AIR QUALITY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection (Standards for Air Quality) Regulations 2000

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Chimney” means a structure or opening from or through which a product of combustion or an air pollutant is emitted into the atmosphere;

“enforcing agency” means the EPA, Factories Inspectorate, District Assemblies or Mines Department.

“existing factories” means factories which entered into operation before the commencement of these regulations;

“factory” has the same meaning as in section 83(I) and (II) of the Factories and Shops Act, 1970 (Act 328).

“industrial process” means any process operated at a factory which may entail a pollutant being emitted into the atmosphere;

“smoke” includes all fine, strong, light absorbing particulate matter emitted from or through a chimney, exhaust or from open burning that eventually become suspended in the ambient atmosphere.

3. (1) The national environmental standards for the emission of pollutants from stacks into the atmosphere shall be those set out in the First Schedule.

(2) Every factory shall comply with the emission standards set out in the First Schedule.

(3) Existing factories shall comply with the emission standards set out into the First Schedule as from

4. (1) The enforcing agency may require that a chimney serving an industrial process be fitted with an aperture for the insertion of a probe to measure the composition, characteristics and quantities of emissions.

(2) The aperture shall be in the chimney wall and shall be of such size and within such height as the enforcing agency may require.

(3) The enforcing agency may require that a safe means of access to the aperture be provided for the purpose of monitoring emissions from the chimney.

(4) Notwithstanding the other provisions of these regulations, the enforcing agency may decide that certain parameters in the First Schedule shall not apply to any specific chimney.

5. (1) The national environmental standards for ambient air quality shall be those set out in the Second Schedule.

(2) In exercising its powers under these regulations, the enforcing agency may take account of the national environmental quality standards set out in the Second Schedule.

6. (1) The enforcing agency may use standard measuring instruments for the purpose of assessing the quality of air.

(2) Measuring instruments shall, for the purpose of these regulations include-

- (a) any standard apparatus for separating any air impurity from the gas or liquid medium in which it is carried;
- (b) any standard device to indicate or record air pollution or give warning of excessive air pollution; and
- (c) any other device used for the purposes of preventing or limiting air pollution.

Date of notification

Date of entry into force

SCHEDULE 2

(regulation No.....)

Stack Emission Standards

The following standards are maximum limits for the corresponding pollutant

	Pollutant	Applicable to	Standard
(i)	Smoke	All Stationary fuel burning source	Ringlemann No.2 or equivalent opacity (not to exceed more than 5 minutes in any period or one hour)
(ii)	Solid particles	Any trade, industry, process, industrial plant or fuel-burning equipment	200 mg/m ³
(iii)	Sulphuric acid mist or sulphur trioxide	a) Any trade, industry or process (other than combustion processes and plants for the manufacture of sulphuric acid) b) Any trade, industry or process in which sulphuric acid is manufactured.	120 mg/m ³ as sulphur trioxide 30,000mg/m ³ as sulphur trioxide
(iv)	Fluorine compounds	Any trade, industry or process in the operation of which fluorine, hydrofluoric acid or any inorganic fluorine compounds are emitted	100mg/m ³ as hydrofluoric acid
(v)	Hydrogen Chloride	Any trade, industry or process	200mg/m ³ as hydrogen chloride
(vi)	Chlorine	Any trade, industry or process	100mg/m ³ as chlorine
(vii)	Hydrogen sulphide	Any trade, industry or process	5 ppm as hydrogen sulphide gas
(viii)	Nitric acid or oxides or nitrogen	Any trade, industry or process in which the manufacture of nitric acid is carried out	2000 mg/m ³ as nitrogen dioxide
(ix)	Nitric acid or oxides of Nitrogen	Any trade, industry or process other than nitric acid plant	1000 mg/m ³ as nitrogen dioxide
(x)	Carbon monoxide	Any trade, industry or process	1000 mg/m ³ as carbon monoxide

SCHEDULE 3
(Regulation)
Ambient Air Quality Standards and Measurement Methods Standard

Substance	Time weighted average, (TWA)		Averaging Time
Sulphur Dioxide (SO ₂)	900 µg/m ³	Industrial	1 hr
	700 µg/m ³	Residential	1 hr
	150 µg/m ³	Industrial	24 hrs
	100 µg/m ³	Residential	24 hrs
	80 µg/m ³	Industrial	1 yr
	50 µg/m ³	Residential	1 yr
Nitrogen Oxides (measured as NO ₂)	400 µg/m ³	Industrial	1 hr.
	--	Residential	1 hr.
	150 µg/m ³	Industrial	24 hrs.
	60 µg/m ³	Residential	24 hrs.
Total Suspended Particulate (TSP/SPM)	230 µg/m ³	Industrial	24 hrs
	150 µg/m ³	Residential	24 hrs
	75 µg/m ³	Industrial	1 yr
	60 µg/m ³	Residential	1 yr
PM ₁₀	70 µg/m ³		24 hrs
Smoke	150 µg/m ³	Industrial	24 hrs
	100 µg/m ³	Residential	24 hrs
	50 µg/m ³	Industrial	1 yr
	30 mg/m ³	Residential	1 yr
Carbon Monoxide (CO)	100 mg/m ³		15 mins
	60 mg/m ³		30 mins
	30 mg/m ³		1 hr
	10 mg/m ³		8 hrs
Hydrogen Sulphide (H ₂ S)	150 µg/m ³		24 hrs
Mercury (Hg.)	1 µg/m ³		1 yr.
Lead (Pb)	2.5 µg/m ³		1 yr
Cadmium (Cd)	10 - 20 ng/m ³		1 yr
Manganese (Mn)	1 µg/m ³		24 hrs
Dichloromethane (Methylene Chloride)	3 mg/m ³		24 hrs
1,2 Dichloroethane	0.7 mg/m ³		24 hrs)
Trichloroethane	1 mg/m ³		24 hrs)
Tetrachloroethene	5 mg/m ³		24 hrs)
Toluene	8 mg/m ³		24 hrs)
Arsenic	6 mg/1	Industrial	24 hrs
	3 mg/1	Residential	24 hrs
Flouride	10 µg/1		24 hrs

STANDARDS FOR NOISE QUALITY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environment Protection Agency (Environmental Standards for Noise) Regulations 2000.

2. In these regulations-

Noise is defined as an unwanted or unpleasant sound capable of making us tired, unhappy, unhealthy, disturbing our sleep and extremely uncomfortable or annoyed as well as interfere with noise sounds we want to hear.

Noise is measured by the use of a sound level meter, an instrument designed to respond to sound pressure in approximately the same way as the human ear.

“dB(A)” - means the equivalent A-weighted sound pressure level measured in decibel;

“factory” - has the same meaning as in section 83(1) (2) of Act 328

“noise” - means

“industrial noise” - means noise generated by a factory;

“neighbourhood noise” - means any noise other than -

(a) industrial noise; or

(b) noise made by an aircraft, an animal or traffic

3. The environmental noise quality standards shall be the standards specified in the Schedule.

4. Regulation 3 shall not, for a period of 1 year as from the commencement of these regulations, apply to industrial noise if the activity generating such noise has already started before commencement of these regulations.

5. (1) Noise measurements shall, as far as practicable, be effected at a minimum distance of one metre from the nearest opening of any residential building facing the noise source or from the factory fence and at 1.2 to 1.5 metres above the ground or floor level and away from walls, buildings or at least 3.5m from other sound reflecting surfaces (ISO/R 1996).

(2) The measurement methods and equipment used shall be those approved by the enforcing agency or indicated in Regulation 2 Paragraph 2.

6. Date of notification of regulations

7. These regulations shall come into operation on

SCHEDULE 4**(Regulation)**

Ambient Noise Level Standards

ZONE	DESCRIPTION OF AREA OF NOISE RECEPTION	PERMISSIBLE NOISE LEVEL IN dB(A)	
		DAY 0600 - 2200	NIGHT 2200 – 0600
A	Residential areas with negligible or infrequent transportation	55	48
B1	Educational (school) and health (hospital clinic) facilities	55	50
B2	Areas with some commercial or light industry	60	55
C1	Areas with some light industry, places of entertainment or public assembly, and places of worship such as churches and mosques	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial areas	70	60
E	Predominantly heavy industrial areas	70	70

SCHEDULE 4**Permissible adjustment to measured noise level for intermittent noise**

Cumulative period for which intermittent noise is present in any hour	Maximum allowable adjustment above the permissible ambient level (dB _A)
More than 15 minutes	± 0
Exceeding 5 minutes but not exceeding 15 minutes	-5
Exceeding 1 minute but not exceeding 5 minutes	-10
Not exceeding 1 minute	-15

Note 1 : This schedule is for the calculation from its duration of the potential annoyance level where any noise present and measured is intermittent and not measured by statistical method.

Note 2: These duration adjustments are not applicable when noise being assessed includes discrete noise impulses or consists of repetitive noise with an impulsive character e.g. hammering or riveting.

GENERAL EFFLUENT LIMITATIONS FOR INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (General Effluent Limitations for Industrial discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Industrial Effluent” means water sullied or contaminated by any matter, in solution or suspension that may cause harm or damage to the environment, derived from its use in connection with an industrial activity.

“Watercourse” means any natural or artificial channel, pipe or conduit carrying or that may carry water and discharging directly or indirectly into a waterbody.

“Waterbody” includes underground water, stream, river, canal, lake, pond, reservoir, estuary, lagoon and sea.

3. (1) Subject to paragraph 2, the national environmental standards for relation to effluent limitations in general, shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by industry.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second or third column of the schedule, as the case may be; and

(c) is discharged from industry, shall be deemed to be a pollutant.

4. Date of notification of General effluent limitation for Industry regulations ...

5. These regulations shall come into operation on

SCHEDULE 1

(Regulation.....)

General Effluent Quality Guidelines for Discharges into Natural Water Bodies

	PARAMETER/DESCRIPTION	MAXIMUM PERMISSIBLE LEVEL
1.	PH	6 – 9
2.	Temperature	<3°C above ambient
3.	Colour (TCU)	200
4.	Oil and Grease (mg/l)	100
5.	BOD ₅ (mg/l)	50
6.	COD (mg/l)	250
7.	Total Dissolved Solids (mg/l) (TDS)	1000
8.	Total Suspended Solids (mg/l) (TSS)	50
9.	Turbidity (NTU)	75 flagged
10.	Conductivity (µS/cm)	1500 - flagged
11.	Total Coliforms (MPN/100ml)	400
12.	E. Coli (MPN/100ml)	10
13.	Ammonia as N (mg/l)	1.0
14.	Nitrate (mg/l)	50
15.	Flouride (mg/l)	1.0
16.	Phenol (mg/l)	1.0
17.	Sulphide (mg/l)	1.5
18.	Total phosphorus (mg/l)	2.0
19.	Total Cyanide (mg/l)	1.0
20.	Free Cyanide (mg/l)	0.2
21.	Cyanide as Weak Acid Dissociable (mg/l)	0.6
22.	Total Arsenic (mg/l)	0.5
23.	Soluble Arsenic (mg/l)	0.1
24.	Cadmium (mg/l)	<0.1
25.	Chromium (+6) mg/l	0.1
26.	Total chromium (mg/l)	0.5
27.	Copper (mg/l)	2.5
28.	Lead (mg/l)	0.1
29.	Nickel (mg/l)	0.5
30.	Selenium (mg/l)	1.0
31.	Zinc (mg/l)	5
32.	Mercury (mg/l)	0.005
33.	Silver (mg/l)	5 – flagged
34.	Tin (mg/l)	5
35.	Aluminium (mg/l)	5.0
36.	Antimony (mg/l)	1.5
37.	Benzo (a) pyrene (mg/l)	0.05
38.	Chloride (mg/l)	250
39.	Sulphate (mg/l)	200 - flagged
40.	Chlorine	250
41.	Trichloroethylene ((µg/l ¹)	7
42.	Total Hardness (mg/l ¹)	500
43.	Baruim (mg/l ¹)	0.7

44.	PCBs (Tichlonebezene) ($\mu\text{g l}^{-1}$)	20
45.	Manganese (Mn) (mg l^{-1})	0.1
46.	Perchloroethylene ($\mu\text{g l}^{-1}$)	40
47.	Benzene($\mu\text{g l}^{-1}$)	10
48.	Influent raw water	$I^* + 15\%$ of influent parameter

Where I^* is influent raw water

Special Guidelines (Industry)

The threshold value for parameter(s) contained in effluents arising from any operation involving the use of untreated water (i.e. sea, river water, underground water, etc.) shall not be of a quality that is 15% worse than the intake water (influent) quality for all measurable parameters of interests, irrespective of the sector industry. Companies operating under the special guidelines should first seek permission from EPA with regard to the effluents quality.

EFFLUENT LIMITATIONS FOR THE TEXTILE INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Textile Industry Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“textile factory” means a factory or parts thereof in which textiles are produced.

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the textile industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Textile Industry Regulations.....

5. These regulations shall come into operation on

SCHEDULE

(Regulation.....)

	PARAMETER	Maximum Permissible Level
1.	pH	6 – 9
2.	Oil & Grease (mg/l)	5
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	400
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.1
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2
11.	Total Coliforms (MPN/100 ml)	400
12.	Turbidity (N.T.U.)	75
13.	Total Suspended Solids (mg/l)	50
14.	Lead (mg/l)	0.1
15.	Nitrate (mg/l)	50
16.	Total Phosphorous (mg/l)	2
17.	Conductivity (µS/cm)	1500
18.	Mercury (mg/l)	0.005
19.	Ammonia as N (mg/l)	1.5
20.	Total Arsenic (mg/l)	1.0
21.	Soluble Arsenic (mg/l)	0.1
22.	Alkalinity as CaCO ₃ (mg/l)	150
23.	Fluoride (mg/l)	
24.	Chloride (mg/l)	250
25.	Copper (mg/l)	5
26.	Trichloroethylene (µg/l)	70
27.	Perchloroethylene (µg/l)	40
28.	Benzene (µg/l)	10

EFFLUENT LIMITATIONS FOR THE FOOD AND BEVERAGES INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Food and Beverages Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Food and Beverages factory” means a factory or parts thereof in which food and beverages are produced.

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Food and Beverages industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for the food and beverages Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulation)

	PARAMETER	Maximum Permissible Level
1.	pH	6 - 9
2.	Oil & Grease (mg/l)	5
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	200
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.05
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2
11.	Total Coliforms (MPN/100 ml)	400
12.	Turbidity (N.T.U.)	75
13.	Total Suspended Solids (mg/l)	50
14.	Lead (mg/l)	0.1
15.	Nitrate (mg/l)	50
16.	Total Phosphorous (mg/l)	2
17.	Conductivity (μS/cm)	1500
18.	Mercury (mg/l)	0.005
19.	Ammonia as N (mg/l)	1.0
20.	Total Pesticides (mg/l)	0.5
21.	Total Arsenic (mg/l)	1.0
22.	Soluble Arsenic (mg/l)	0.1
23.	Alkalinity as CaCO ₃ (mg/l)	150
24.	Fluoride (mg/l)	10
25.	Chloride (mg/l)	250
26.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE PAINTS AND CHEMICALS INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Paints and Chemical Industry Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Paint and Chemicals factory” means a factory or parts thereof in which paints and chemicals are formulated or manufactured.

“Influent raw water” means water diverted from a river, stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Paints and Chemicals industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Paints and Chemicals Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulations

	PARAMETER	Maximum Permissible Level
1.	pH	6 – 9
2.	Oil & Grease (mg/l)	10
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	300
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.1
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2
11.	Total Coliforms (MPN/100 ml)	400
12.	Turbidity (N.T.U.)	75
13.	Total Suspended Solids (mg/l)	50
14.	Lead (mg/l)	0.1
15.	Nitrate (mg/l)	50
16.	Total Phosphorous (mg/l)	2
17.	Conductivity (µS/cm)	1500
18.	Mercury (mg/l)	0.005
19.	Ammonia as N (mg/l)	1.5
20.	Total Pesticides (mg/l)	0.5
21.	Total Arsenic (mg/l)	1.0
22.	Soluble Arsenic (mg/l)	0.1
23.	Alkalinity as CaCO ₃ (mg/l)	150
24.	Fluoride (mg/l)	1.5
25.	Chloride (mg/l)	250
26.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE PHARMACEUTICALS INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Pharmaceutical Industry Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Pharmaceutical factory” means a factory or parts thereof in which pharmaceutical products are produced or formulated.

“Influent raw water” means water diverted from a river, stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Pharmaceuticals industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Pharmaceutical Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulations)

	PARAMETER	Maximum Permissible Level
1.	PH	6 – 9
2.	Oil & Grease (mg/l)	5
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	150
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.005
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2
11.	Total Coliforms (MPN/100 ml)	10
12.	E. Coli (MPN/100 ml)	0
13.	Turbidity (N.T.U.)	75
14.	Total Suspended Solids (mg/l)	50
15.	Lead (mg/l)	0.1
16.	Nitrate (mg/l)	50
17.	Total Phosphorous (mg/l)	2
18.	Conductivity (µS/cm)	1500
19.	Mercury (mg/l)	0.005
20.	Ammonia as N (mg/l)	1.5
21.	Total Arsenic (mg/l)	1.0
22.	Soluble Arsenic (mg/l)	0.1
23.	Alkalinity as CaCO ₃ (mg/l)	
24.	Fluoride (mg/l)	1.5
25.	Chloride (mg/l)	250
26.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE PAPER AND PULP INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Paper and Pulp Industry Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Paper and Pulp factory” means a factory or parts thereof in which paper and pulp are produced/treated or harnessed.

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Paper and Pulp industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Paper and Pulp Industry Regulations

5. These regulations shall come into operation on

Made by the Minister on

SCHEDULE

(Regulations.....)

	PARAMETER	Maximum Permissible Level
1.	pH	6 - 9
2.	Oil & Grease (mg/l)	10
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	200
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.1
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2
11.	Total Coliforms (MPN/100 ml)	400
12.	Turbidity (N.T.U.)	75
13.	Total Suspended Solids (mg/l)	50
14.	Lead (mg/l)	0.1
15.	Nitrate (mg/l)	50
16.	Total Phosphorous (mg/l)	2
17.	Conductivity (µS/cm)	1500
18.	Mercury (mg/l)	0.005
19.	Ammonia as N (mg/l)	1.5
20.	Total Arsenic (mg/l)	1.0
21.	Soluble Arsenic (mg/l)	0.1
22.	Alkalinity as CaCO ₃ (mg/l)	150
23.	Fluoride (mg/l)*	1.5
24.	Chloride (mg/l)	250
25.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE HOTELS AND RESORTS INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of 2000

1. These regulations may be cited as the Environmental Protection Agency (Hotels and Resorts Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Hotels and Resorts factory” means a factory

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Hotels and Resorts industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Hotels and Resorts Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulation.....)

	PARAMETERS	Maximum Permissible Level
1.	PH	6 - 9
2.	Oil & Grease (mg/l)	5
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	500-1800
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.1
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2
11.	Total Coliforms (MPN/100 ml)	400
12.	E. Coli (MPN/100 ml)	10
13.	Turbidity (N.T.U.)	flagged
14.	Total Suspended Solids (mg/l)	50
15.	Lead (mg/l)	0.1
16.	Nitrate (mg/l)	50
17.	Total Phosphorous (mg/l)	2
18.	Conductivity (μS/cm)	1500
19.	Mercury (mg/l)	0.005
20.	Ammonia as N (mg/l)	1.0
21.	Total Arsenic (mg/l)	1.0
22.	Soluble Arsenic (mg/l)	0.1
23.	Alkalinity as CaCO ₃ (mg/l)	500
24.	Fluoride (mg/l)	1.5
25.	Chloride (mg/l)	250
26.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE WOOD AND WOOD PROCESSING INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of 2000

1. These regulations may be cited as the Environmental Protection Agency (Wood and Wood Processing Industry Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Wood and Wood processing factory” means a factory or parts thereof in which wood is treated, processed or value is added.

“Influent raw water” means water diverted from a river, stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Wood and Wood Processing industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Wood and Wood Processing Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulation

	PARAMETERS	Maximum Permissible Level
1.	PH	6 - 9
2.	Oil & Grease (mg/l)	5
3.	Temperature increase	< 3°C above ambient
4.	Colour (TCU)	250
5.	COD (mg/l)	250
6.	BOD ₅ (mg/l)	50
7.	Total Dissolved Solids (mg/l)	1000
8.	Chromium (+6) mg/l	0.1
9.	Sulphide (mg/l)	1.5
10.	Phenol (mg/l)	2.0
11.	Total Coliforms (MPN/100 ml)	400
12.	Turbidity (N.T.U.)	Flagged
13.	Total Suspended Solids (mg/l)	50
14.	Lead (mg/l)	0.1
15.	Nitrate (mg/l)	50
16.	Total Phosphorous (mg/l)	2
17.	Conductivity (µS/cm)	1500
18.	Mercury (mg/l)	0.005
19.	Ammonia as N (mg/l)	1.0
20.	Total Arsenic (mg/l)	1.0
21.	Soluble Arsenic (mg/l)	
22.	Alkalinity as CaCO ₃ (mg/l)	500
23.	Fluoride (mg/l)	1.5
24.	Chloride (mg/l)	250
25.	PCB (Trichlorobenzene) µg/l	<50
26.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE CEMENT, CERAMICS AND TILES INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Cement, Ceramics and Tiles Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Cement, Ceramics and Tiles factory” means a factory or parts thereof in which cement, ceramics and tiles are produced.

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Cement, Ceramics and Tiles industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

- (a) has one or more of the parameters specified in the first column of the schedule;
- (b) does not comply with the corresponding limit specified in the second column of the schedule; and
- (c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Cement, Ceramics and Tiles Industry Regulations

5. These regulations shall come into operation on

Made by the Minister on2000

SCHEDULE

(Regulations)

	PARAMETER	Maximum Permissible Level
1.	PH	6 - 9
2.	BOD ₅ (mg/l)	50
3.	Oil & Grease (mg/l)	5
4.	Total Dissolved Solids (mg/l)	1000
5.	Total Suspended Solids (mg/l)	50
6.	Cadmium (mg/l)	0.1
7.	Total Phosphorus (mg/l)	2.0
8.	Temperature increase	< 3°C above ambient
9.	Colour (TCU)	200
10.	COD (mg/l)	250
11.	Chromium (+6) mg/l	0.1
12.	Sulphide (mg/l)	1.5
13.	Phenol (mg/l)	
14.	Total Coliforms (MPN/100 ml)	
15.	Turbidity (N.T.U.)	flagged
16.	Lead (mg/l)	0.1
17.	Nitrate (mg/l)	50
18.	Conductivity (µS /cm)	1500
19.	Mercury (mg/l)	
20.	Zinc (mg/l)	3.0
21.	Tin (mg/l)	
22.	Total Chromium (mg/l)	
23.	Total Iron (mg/l)	0.3
24.	Free Cyanide (mg/l)	
25.	Cyanide as Weak Acid Dissociable (mg/l)	
26.	Total Cyanide (mg/l)	
27.	Aluminium (mg/l)	0.2
28.	Total Antimony (mg/l)	
29.	Fluoride (mg/l)	
30.	Chloride (mg/l)	
31.	Alkalinity as CaCO ₃ (mg/l)	
32.	Copper (mg/l)	
33.	Total Arsenic (mg/l)	1.0
34.	Soluble Arsenic (mg/l)	0.1
35.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE THERMAL POWER PLANT INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Thermal Power Plants Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Thermal Power Plant ” means an electrical power generating plant other than solar or hydropower that uses gas and/or (crude) oil as fuel

“Influent raw water” means water diverted from a river, stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Thermal Power Plant industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second column of the schedule; and

(c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Thermal Power Plant Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulations)

	PARAMETER	Maximum Permissible Level
1.	PH	6 - 9
2.	BOD ₅ (mg/l)	50
3.	Oil & Grease (mg/l)	5
4.	Total Dissolved Solids (mg/l)	
5.	Total Suspended Solids (mg/l)	50
6.	Cadmium (mg/l)	
7.	Total Phosphorus (mg/l)	2.0
8.	Temperature increase	< 5°C above ambient
9.	Colour (TCU)	200
10.	COD (mg/l)	250
11.	Chromium (+6) mg/l	
12.	Sulphide (mg/l)	1.5
13.	Phenol (mg/l)	
14.	Total Coliforms (MPN/100 ml)	
15.	Turbidity (N.T.U.)	75
16.	Lead (mg/l)	0.1
17.	Nitrate (mg/l)	50
18.	Conductivity (µS /cm)	
19.	Mercury (mg/l)	
20.	Zinc (mg/l)	
21.	Tin (mg/l)	
22.	Total Chromium (mg/l)	
23.	Total Iron (mg/l)	
24.	Free Cyanide (mg/l)	
25.	Cyanide as Weak Acid Dissociable (mg/l)	
26.	Total Cyanide (mg/l)	
27.	Aluminium (mg/l)	
28.	Total Antimony (mg/l)	
29.	Fluoride (mg/l)	
30.	Chloride (mg/l)	
31.	Alkalinity as CaCO ₃ (mg/l)	
32.	Copper (mg/l)	
33.	Total Arsenic (mg/l)	
34.	Soluble Arsenic (mg/l)	
35.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE GLASS INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Glass Industries Effluent Limitations for discharges into natural water bodies) Regulations 2000

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Glass factory” means a factory or parts thereof in which glass is manufactured.

“Influent raw water” means water diverted from a river, stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Glass industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second column of the schedule; and

(c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Glass Industry Regulations
.....

5. These regulations shall come into operation on

SCHEDULE

(Regulations)

	PARAMETER	Maximum Permissible Level
1.	pH	6 - 9
2.	BOD ₅ (mg/l)	50
3.	Oil & Grease (mg/l)	5
4.	Total Dissolved Solids (mg/l)	1000
5.	Total Suspended Solids (mg/l)	50
6.	Cadmium (mg/l)	0.003
7.	Total Phosphorus (mg/l)	2.0
8.	Temperature increase	< 5°C above ambient
9.	Colour (TCU)	150
10.	COD (mg/l)	250
11.	Chromium (+6) mg/l	0.1
12.	Sulphide (mg/l)	1.5
13.	Phenol (mg/l)	
14.	Total Coliforms (MPN/100 ml)	400
15.	Turbidity (N.T.U.)	75 - flagged
16.	Lead (mg/l)	0.1
17.	Nitrate (mg/l)	50
18.	Total Arsenic (mg/l)	2
19.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE HOSPITALS AND POLYCLINICS INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Hospital and Polyclinics Effluent Limitations for discharges into natural water bodies) Regulations 2000.

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Hospitals and Polyclinics ” means

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Hospitals and Polyclinics industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second column of the schedule; and

(c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Hospitals and Polyclinics Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulations)

	PARAMETER	Maximum Permissible Level
1.	PH	6 - 9
2.	BOD ₅ (mg/l)	50
3.	Oil & Grease (mg/l)	5
4.	Total Dissolved Solids (mg/l)	1000
5.	Total Suspended Solids (mg/l)	50
6.	Cadmium (mg/l)	0.003
7.	Total Phosphorus (mg/l)	2.0
8.	Temperature increase	< 3°C above ambient
9.	Colour (TCU)	50-60
10.	COD (mg/l)	250
11.	Chromium (+6) mg/l	0.1
12.	Sulphide (mg/l)	1.5
13.	Phenol (mg/l)	2
14.	Total Coliforms (MPN/100 ml)	400
15.	E. Coli (MPN/100 ml)	10
16.	Turbidity (N.T.U.)	flagged
17.	Lead (mg/l)	0.1
18.	Nitrate (mg/l)	50
19.	Conductivity (µS /cm)	1500
20.	Mercury (mg/l)	0.005
21.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE OIL AND GAS EXPLORATION, PRODUCTION AND REFINING INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Oil and Gas Exploration, Production and Refining Effluent Limitations for discharges into natural water bodies) Regulations 2000

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Oil and Gas Exploration, Production and Refining factory ” means an

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Oil and Gas Exploration, Processing and Refining industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second column of the schedule; and

(c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Oil and Gas Exploration, Production and Refining Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulations

	PARAMETER	Maximum Permissible Level
1.	pH	6 - 9
2.	BOD ₅ (mg/l)	50
3.	Oil & Grease (mg/l)	10
4.	Total Dissolved Solids (mg/l)	1000
5.	Total Suspended Solids (mg/l)	50
6.	Cadmium (mg/l)	0.1
7.	Total Phosphorus (mg/l)	2.0
8.	Temperature increase	< 3°C above ambient
9.	Colour (TCU)	200
10.	COD (mg/l)	250
11.	Chromium (+6) mg/l	0.1
12.	Sulphide (mg/l)	1.5
13.	Phenol (mg/l)	2.0
14.	Total Coliforms (MPN/100 ml)	400
15.	Turbidity (N.T.U.)	75 - flagged
16.	Lead (mg/l)	0.1
17.	Nitrate (mg/l)	50
18.	Conductivity (µS /cm)	1500
19.	Mercury (mg/l)	0.005
20.	Zinc (mg/l)	10
21.	Tin (mg/l)	
22.	Total Chromium (mg/l)	0.5
23.	Total Iron (mg/l)	10
24.	Free Cyanide (mg/l)	
25.	Cyanide as Weak Acid Dissociable (mg/l)	
26.	Total Cyanide (mg/l)	
27.	Aluminium (mg/l)	
28.	Total Antimony (mg/l)	
29.	Fluoride (mg/l)	1.5
30.	Chloride (mg/l)	250
31.	Alkalinity as CaCO ₃ (mg/l)	
32.	Copper (mg/l)	5.0
33.	Total Arsenic (mg/l)	
34.	Soluble Arsenic (mg/l)	
35.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE MINING AND MINERAL PROCESSING INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Mining and Mineral Processing Effluent Limitations for discharges into natural water bodies) Regulations 2000

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Mining and Minerals Processing plant” means a

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Mining and Mineral Processing industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second column of the schedule; and

(c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Mining and Mineral Processing Industry Regulations

5. These regulations shall come into operation on

SCHEDULE

(Regulations)

	PARAMETER	Maximum Permissible Level
1.	pH	6 - 9
2.	Oil & Grease (mg/l)	10
3.	Total Dissolved Solids (mg/l)	1000
4.	Total Suspended Solids (mg/l)	50 influent + 15%
5.	Cadmium (mg/l)	0.1
6.	Total Phosphorus (mg/l)	2.0
7.	Temperature increase	< 3°C above ambient
8.	Colour (TCU)	150
9.	COD (mg/l)	250
10.	Chromium (+6) mg/l	0.1
11.	Sulphide (mg/l)	1.5
12.	Phenol (mg/l)	2
13.	Total Coliforms (MPN/100 ml)	400
14.	Turbidity (N.T.U.)	flagged
15.	Lead (mg/l)	0.1
16.	Nitrate (mg/l)	50
17.	Conductivity (μ S /cm)	2000
18.	Mercury (mg/l)	0.005
19.	Zinc (mg/l)	10
20.	Tin (mg/l)	
21.	Total Chromium (mg/l)	0.5
22.	Total Iron (mg/l)	10
23.	Free Cyanide (mg/l)	0.2
24.	Cyanide as Weak Acid Dissociable (mg/l)	0.6
25.	Total Cyanide (mg/l)	1.0
26.	Aluminium (mg/l)	
27.	Total Antimony (mg/l)	1.5
28.	Fluoride (mg/l)	
29.	Chloride (mg/l)	250
30.	Alkalinity as CaCO ₃ (mg/l)	
31.	Copper (mg/l)	5
32.	Total Arsenic (mg/l)	1.0
33.	Soluble Arsenic (mg/l)	0.1
34.	Others*	

* See General Effluent Limitations for Industry

EFFLUENT LIMITATIONS FOR THE METAL INDUSTRY

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Metal Industry Effluent Limitations for discharges into natural water bodies) Regulations 2000

2. In these regulations -

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Metals factory” means a factory or parts thereof in which metals are fabricated or processed.

“Influent raw water” means water diverted from a river stream, spring or canal or water abstracted from underground and used by a factory.

3. (1) Subject to paragraph 2, the national environmental standards in relation to effluent limitations for the Metals industry in general shall be as set out in the schedule.

(2) Paragraph (1) shall apply to effluents discharged underground or into a river, stream, spring, canal, reservoir or lake by factory.

(3) Any effluent which-

(a) has one or more of the parameters specified in the first column of the schedule;

(b) does not comply with the corresponding limit specified in the second column of the schedule; and

(c) is discharged from a factory,

shall be deemed to be a pollutant.

4. Date of notification of the effluent limitations for Metal Industry Regulations

4. These regulations shall come into operation on

SCHEDULE

(Regulations)

	PARAMETER	Metals Industry
1.	pH	6 - 9
2.	BOD ₅ (mg/l)	50
3.	Oil & Grease (mg/l)	5
4.	Total Dissolved Solids (mg/l)	1000
5.	Total Suspended Solids (mg/l)	50
6.	Cadmium (mg/l)	0.1
7.	Total Phosphorus (mg/l)	2.0
8.	Temperature (°C)	< 3°C above ambient
9.	Colour (TCU)	200
10.	COD (mg/l)	250
11.	Chromium (+6) mg/l	0.1
12.	Sulphide (mg/l)	1.5
13.	Phenol (mg/l)	2
14.	Total Coliforms (MPN/100 ml)	400
15.	Turbidity (N.T.U.)	fabricated
16.	Lead (mg/l)	0.1
17.	Nitrate (mg/l)	50
18.	Conductivity (µS /cm)	1500
19.	Mercury (mg/l)	0.005
20.	Zinc (mg/l)	10
21.	Tin (mg/l)	5
22.	Total Chromium (mg/l)	
23.	Total Iron (mg/l)	10
24.	Free Cyanide (mg/l)	
25.	Cyanide as Weak Acid Dissociable (mg/l)	
26.	Total Cyanide (mg/l)	
27.	Aluminium (mg/l)	5.0
28.	Total Antimony (mg/l)	1.5
29.	Fluoride (mg/l)	10
30.	Chloride (mg/l)	250
31.	Alkalinity as CaCO ₃ (mg/l)	150
32.	Copper (mg/l)	5
33.	Total Arsenic (mg/l)	1.0
34.	Soluble Arsenic (mg/l)	0.1
35.	Others*	

* See General Effluent Limitations for Industry

APPLICATION FOR AN INDUSTRIAL EFFLUENT DISCHARGE PERMIT

In exercise of the powers conferred on the Minister responsible for the Environment under section 28 of the Environmental Protection Agency Act, 1994 (Act 490) and on the advice of the Environmental Protection Agency Board, these Regulations are made this day of2000

1. These regulations may be cited as the Environmental Protection Agency (Industrial Effluent Discharge Permit) Regulations 2000.

2. In these regulations-

“Act” means the Environmental Protection Agency Act, 1994 (Act 490)

“Permit” means an Industrial Effluent Discharge Permit issued under regulation

“Industrial effluent” means water sullied or contaminated by any matter, in solution or suspension that may cause harm or damage to the environment, derived from its use in connection with an industrial activity;

“watercourse” means any natural or artificial channel, pipe or conduit carrying or that may carry water and discharging directly or indirectly into waterbody;

“waterbody” includes underground water, stream, river, canal, lake, pond, reservoir, estuary, lagoon and sea;

3. (1) No person shall discharge or cause to be discharged any industrial effluent into a watercourse or waterbody unless he has an Industrial Effluent Discharge Permit from the Environmental Protection Agency.

(2) Notwithstanding paragraph 3(1), no person shall discharge or cause to be discharged any industrial effluent into-

(a) any watercourse through which water used for domestic purposes runs; or

(b) any waterbody in which water used for domestic purposes is kept.

(c) any waterbody in which water used for aqua culture shrimp/fish farming is carried out

(3) A person who wishes to obtain a permit referred to in paragraph 3(1) shall make an application to the Environmental Protection Agency

4. (1) An application for a permit shall be made in the form set out in the First Schedule.

(2) In the case of an enterprise already in operation at the time of an application, the person in charge of the management of the enterprise

shall submit a certificate showing the result of an analysis of the industrial effluent together with the application for a permit.

- (3) Where an analysis of industrial effluent is required under paragraph 4(2), it shall be conducted in such a manner as may be approved by the Environmental Protection Agency.

5. (1) Where the Environmental Protection Agency is satisfied that an applicant has complied with the Act and any regulation made under the Act, it may grant a permit to the applicant upon payment of a fee of cedis.

- (2) A permit issued under paragraph 5(1) shall specify-

(a) the maximum volume of industrial effluent, that may be discharged daily;

(b) the quality of the industrial effluent that may be discharged

(c) the maximum rate at which any industrial effluent may be discharged at any time;

(d) the frequency of sampling and location of sampling points of the industrial effluent; and

(e) the frequency of analysis to be conducted in respect of the industrial effluent.

- (3) A permit shall be valid for a period of one year.

6. (1) The person in charge of the management of the enterprise shall cause the result of analysis of an industrial effluent to be sent to the Environmental Protection Agency on a monthly basis, specifying the date, time and location of sampling for each and every sample.

- (2) The method of sampling, the sample storage and method of analysis shall be those approved by the Environmental Protection Agency.

7. (1) An application for the renewal of a permit shall be made-

(a) in the form set out in the Second Schedule;

(b) at least 3 months before the expiry of the permit.

- (2) The Environmental Protection Agency may renew a permit if it is satisfied that the applicant has complied with the Act, any regulation made under the Act and upon payment of a fee of Cedis.

8. (1) Subject to paragraph 8(2) where the holder of a permit fails to comply with these regulations, the Environmental Protection Agency may revoke the permit;

- (2) The Environmental Protection Agency shall not revoke a permit unless it has requested the holder thereof to submit the reasons in writing why his permit should not be revoked.
- (9) Date of notification of regulations for application for an industrial effluent discharge permit
- (10) These regulations shall come into force on 1999

FIRST SCHEDULE

Regulation

APPLICATION FOR A PERMIT IN RESPECT OF DISCHARGE OF ANY INDUSTRIAL EFFLUENT INTO ANY WATERCOURSE OR WATERBODY

To: **ENVIRONMENTAL PROTECTION AGENCY**

PARTICULARS OF APPLICANT

1. Name of industry

Address

2. Name of person responsible

Address

Phone No./Fax No.

E-mail

3. Location of discharge point (location plan to be annexed) indicating GPS positioning:.....
.....

4. Nature and composition of the industrial effluents to be discharged (Analysis certificate/s to be attached where appropriate)
.....
.....

5. Frequency of industrial effluent discharged daily

6. Maximum daily volume of industrial effluent to be discharged

7. Maximum rate of discharge per second

8. Method of sampling

Frequency

Location

9. Method of analysis per parameter *

.....

.....

I/We request that I/We may be granted an Industrial Effluent Discharge Permit in accordance with the particulars given above.

I/We undertake to comply with prescribed standards.

I/We also undertake to submit to the Environmental Protection Agency a monthly return of our compliance monitoring data.

Date

.....
Name of applicant

.....
Signature of applicant

* *A list of approved methods on sampling, sample storage and methods of analysis is available at the Environmental Protection Agency*

FOR OFFICE USE ONLY

Permit No.

Issued on

Reference

Date

SECOND SCHEDULE

Regulation

APPLICATION FOR THE RENEWAL OF AN INDUSTRIAL EFFLUENT DISCHARGE PERMIT

To: ***ENVIRONMENTAL PROTECTION AGENCY***

I/We
being licensed to discharge industrial effluent into
hereby apply for the renewal of my/our permit No.

dated

Date
Name of applicant
.....
Signature of applicant

FOR OFFICE USE ONLY

New Permit No.
Issued on
Reference
Date

**ANNEX V: LIST OF ACTIVE NON GOVERNMENTAL ORGANIZATIONS
REGISTERED WITH EPA**

NO.	NAME OF NGO	POSTAL ADDRESS	LOCATION	OPERATIONAL AREAS
1.	Suntaa Nuntaa Rural Development Programme	P.O. Box 207, Upper West Region	Wa	Agro Forestry/Rural Development.
2.	Ghana Wildlife Society	Box 13252, Accra	Accra	Protection of Game and Wildlife, Environmental Education
3.	Collaborative Community Forestry Initiative (CCFI)	C/o P.O. Box 60, Wa	Jirapa	Afforestation, education
4.	Technoserve	Box 135, Accra	Accra	Environmental Education Provision of Social Infrastructure
5.	Bongo Agro-forestry Project	P.O. Box 5, Bongo	Bongo	Agro Forestry
6.	Gia-Nabio Agro Forestry Development Organisation	P.O. Box 55, Navrongo	Navrongo	Tree Nursery/Planting & Agro-Forestry
7.	VUUM Tree Planting & Nursery Society	P.O. Box 9, Sandema	Sandema	Tree planting, environmental education
8.	Environmental Protection Association of Ghana	P.O. Box AS.32, Kumasi	Asawasi	Environmental Education Conservation and Afforestation
9.	Jamasiman Nkosoo Kuo	P.O. Box 172, UST, Kumasi	Jamasi - Ashanti	Agroforestry, Health and Environmental Education
10.	Ele Friends of Ghana	P.O. Box 172, UST, Kumasi	Worakose	Environmental Education Agroforestry
11.	Ghana Rural Reconstruction Movement	P.O. Box 14, Mampong Akuapim	Mampong Akuapim	Developmental Projects forestry, Sustainable Agric.
12.	Assin Tree Planting Association	Box 18, Assin Manso Central Reg	Assin District	Tree Planting, Environmental Education
13.	Conservation International	Accra	Accra	Conservation programmes Environmental education
14.	Friends of the Nation	Box 011, Takoradi Tel 031 -23283 Shama Ahanta East	Daboase Takoradi	Agro Forestry/Health Education Campaign
15.	World Vision International	P.M.B., Accra-North	Accra	Environmental/Natural Resources Management & Sustainable Agric.
16.	Gender Awareness Foundation	P.O. Box 667, GIJ, Accra	Accra	Organisation of seminars on environmental issues
17.	Voluntary Work Camp Association	P.O. Box 1540, Accra	Accra	Afforestation Provision of Social Infrastructure Environmental/Health Education.
18.	ADRA	Box 1435, Accra	Accra	Agro forestry, provision of social infrastructure
19.	Evergreen Club of Ghana	P.O. Box 168, Accra	Trade Fair	Tree Planting, Agroforestry Environmental Education
20.	Centre for Environmental Health & Safety Programmes	P.O. Box T.A. 526, Accra	Taifa	Environmental And Safety Programmes Design, Conduct Training Programmes Research

National Implementation Plan – Ghana

				into Environmental Quality
21.	Friends of the Earth	PMB, Accra	Accra	Tree Planting, Environmental Education
22.	Green Earth Organisation	P.O. Box 16641, Accra-North	Accra	Environmental Education Environmental Cleanliness/ Conservation, Tree Planting
23.	Agenda 21 Environmental Welfare Association of Ghana	P.O. Box AC.475, Accra	Arts Centre	Environmental Management
24.	Amasachina Self Help Association	P.O. Box 798, Tamale	Tamale	Environmental Education Agro forestry
25.	World Vision International Ghana	P.M.B, Accra-North	Accra	Environmental/Natural Resources Management & Sustainable Agric.
26.	Environment Youth Action Network	P. O. LG 455, Legon, Accra	Accra	Public Education and Awareness Creation, Information Communication, Training, Afforestation
27.	Environmental Concerns Centre of Ghana	Civil Aviation Authority, PMB. KIA, Accra	Accra	Environmental Education Sanitation
28.	Green Belt Foundation	P.O. Box CE11263, Tema	Community II	Tree Planting
29.	Rescue Mission, Ghana	P.O. Box 1171, Teshie Nungua Estate	Accra	Environmental Education Human Rights, Sustainable Development
30.	African Association for Health Environment and Development	P.O. Box LG.709, University of Ghana	Legon	Health Education Environmental Education Development Projects.
31.	Association of Women for the Preservation of the Environment	P.O. Box 5737, Accra-North	Accra-North	Environmental Education Environmental Cleanliness
32.	Association of the Advancement of Women in Africa	P.O. Box 5737, Accra-North	Accra-North	Awareness Creation (Gender) Issues etc.
33.	La Masaamokpee	P.O. Box A92, Accra	La	Environmental Cleanliness/ Education
34.	Apiculture with Trees Agro-foresters Association of West Africa	P.O. Box 5645, Accra-North	Accra-North	Environmental Education Agro-Forestry, Bee-Keeping
35.	League of Environmental Journalists	P.O. Box 2062, Accra	Accra	Environmental Education/ Reporting, Information and Awareness Creation
36.	Green Tropics Group	P.O. Box 14399, Accra	Accra	Afforestation, Environmental. Education Watershed Mgt, Population Control
37.	31 ST December Women's Movement	Box 228711 Accra	Accra	Agro Forestry Developmental Projects
38.	Akuapem Community Development Project	Box 100, Akropong	Akuapim	Provision of water, nurseries, woodlots, tree planting

39.	Friends of Rivers and Water Bodies	C/O Box 1406 Kumasi	Kumasi	Conservation, Tree Planting Advocacy Environmental Education
40.	Ricerca Cooperazione	Box 348, Legon	Accra	Agro forestry, Reforestation Water and Sanitation
41.	Integrated Community Care	P. O. Box SC 168 Tema	Tema	Development of Training Materials, Training Modules, Creating of Public Awareness
42.	Nature Conservation Research Center	Box KN 925 Kaneshie Accra Ghana	Accra	Nature Conservation Research and Education
43.	SNV/Ghana	Box 413, Takoradi	Takoradi	Education, health care, tree planting, nature conservation
44.	Okyeman Environmental Foundation	Ofori Panin Fie, Kyebi	Kyebi	Environmental education, conservation, tree planting
45.	National Union of Tree Grower Association. (NUTREGA)	C/o Box 196, Koforidua	Koforidua	Tree Planting
46.	Afro Cultural Organisation	p. O. Box 301 James Town Accra	Accra	Environmental management
47.	Green Image	P. O. Box TN 1800 Accra	Accra	Eco-tourism, environmental management
48.	African Challenge,	Bespa Services, Private Mail Bag Accra	Accra	Environmental activities, health education, water and sanitation and poverty alleviation
49.	Mafi Agove Vodza Youth and Development Association	P. O. Box 1613 Osu Accra	Accra	Construction of roads, water and sanitation, environmental education
50.	Time for Trees (GH)	P.O Box AM15 Amasaman Accra	Accra	Planting of trees, reforestation
51.	Andyrose Foundation International	P. O. Box 11630 Accra North	Accra	Environmental protection, ecotourism, primary health care.
52.	Environmental Monitoring Foundation	P. O. Box CT2058 Cantoments Accra	Accra	Environmental education, afforestation, waste management and sanitation
53.	Youth Education and Rural life International	P. O. Box DS2089, Dansoman Accra	Accra	Youth empowerment Environmental management
54.	Environmental Concerned Monitoring Group	P. O. Box 18 Jinijini Berekum Brong Ahafo	Berekum	Tree planting, eco-study tours, essay competition
55.	Sustainable poverty eradication and Developmental Association	C/O MOFA P. O. Box EL 52 Elmina		Alleviate hunger and poverty, environmental management
56.	Mount Bethel Development and Relief Service (Bedears)	P. O. Box GP 20072 Accra Central	Accra	Environmental Protection and management, youth empowerment, rural development
57.	Africa Clean Network	P. O. Box CT 4564 Cantoments Accra	Accra	Environmental Management
58.	Waste Wise	P. O. Box AN 19512 Accra	Accra	Education on waste issues and empower vulnerable groups.
59.	Community Care Initiative	P. O. Box 7031 Accra-North	Accra	Plastic refuse recycling, composting organic garbage for biogas, land reclamation systems
60.	Smart Youngsters Club	Box OS 2337 Osu Accra	Accra	Advocacy

61.	1 st Royal Events Ltd	Box 432 Kaneshie Accra	Accra	Environmental Beauty Queen
62.	Earth Volunteers	P. O. Box AD 297 Adabraka Accra	Accra	Primary education, prevention of malaria, environmental protection
63.	Young Adults Organisation of Ghana	P. O. Box GPO 17439 Accra	Accra	Clean up campaign, education on STDs
64.	The Development Institute	P. O. Box AN11613 Accra North	Accra	Education for sustainable development, conflict resolution, peace building
65.	Fight Against Desertification Association	C/o Wilhelm Ltd, P. O. Box 1141, Teshie	Accra	Reforestation and conservation of ecology and water bodies
66.	Western Region Image Builders Organisation	P. O. Box AX 414 Takoradi WR	Takoradi WR	Develop degraded forest and social development of children
67.	Old Alaska Youth Club	P. O. Box KT 523, Kotobabi Accra	Accra	Community development, protection of environment
68.	Eco Restorations	P. O. Box AH 1254, Achimota Accra	Accra	Degraded wetlands, community protected areas, education, landscape restoration
69.	Friends of all nations voluntary organisation	P. O. Box 220, Madina Accra	Accra	Voluntary labour, educational programmes, health care
70.	Northern Development Society	P. O. Box 1456, Tamale	Tamale	Planting of Trees, Advocacy
71.	Doss Care Foundation International	P.O. Box AN 5488, Accra- North	Accra North	Waste Management, Sanitation, HIV/AIDS
72.	Servers Organization	P.O. Box GP 1438, Accra	Kotobabi Down - Accra	Environmental Education, Natural Resource Conservation
73.	Nature Today Group	P.O. Box OSI 1455 Osu-Accra	Accra	Natural Resource Conservation Environmental Management
74.	African Peace Network	P.O. Box DC 297 Dansoman-Accra	Dansoman- Accra	Youth Development, Environmental Education
75.	African Trusteeship Foundation	P.O.BOX KN, Kaneshie, Accra	Kaneshie- Accra	Environmental Education, HIV/AIDS Campaig
76.	Global Civic Preservation	P.M. B 255, Accra-North	Accra	Environmental Education Community Youth Advocacy
77.	Environment Youth Action Network	P. O. Box LG 455, Legon	Accra	Environmental Education Pollution and waste Management Environmental management

ANNEX VI: LIST OF NATIONAL STAKEHOLDERS

1. Ministry of Local Government, Rural Development and Environment
2. Environmental Protection Agency
3. Department of Town and Country Planning
4. Council for Scientific and Industrial Research
5. Ministry of Lands, Forestry and Mines
6. Mines Department
7. Minerals Commission
8. Ministry of Finance and Economic Planning
9. Customs, Excise and Preventive Service
10. Ministry of Education, Science and Sport
11. Ministry of Health
12. Ghana Health Service
13. Food and Drugs Board
14. Ministry of Food and Agriculture
15. Veterinary Services Department
16. Plant Protection and Regulatory Services Directorate
17. Ministry of Trade, Industry, Private Sector development and President's Special Initiatives
18. Ghana Standards Board
19. Ghana Atomic Energy Commission
20. Ministry of Energy
21. Energy Commission
22. Ghana National Petroleum Company
23. Ministry of Transportation
24. Ministry of Ports, Harbours and Railways
25. Ghana Ports and Harbours Authority
26. Regional Maritime Academy
27. Ministry of Water Resources, Works and Housing
28. Water Resources Commission
29. Ministry of Manpower Development, Youth and Employment
30. Factories Inspectorate Department
31. Ministry of Justice and Attorney General
32. Judicial Service
33. Ministry of Interior
34. Ministry of Women and Children's Affairs
35. Ghana Police Service
36. Ministry of Defence
37. Irrigation Development Authority of Ghana
38. Ghana Association of Farmers and Fishermen
39. Cocoa Services Division of Ghana
40. Cocoa Research Institute of Ghana
41. Pharmacy Council
42. Association of Ghana Industries
43. Electricity Company of Ghana
44. Ghana Water Company Limited
45. Volta River Authority
46. University of Ghana, Legon
47. Kwame Nkrumah University of Science & Technology, Kumasi
48. University of Cape Coast, Cape Coast
49. University of Development Studies, Tamale
50. The Media

ANNEX VII

MAIN PROPOSALS AND PRIORITIES

Project Proposal on Strengthening Institutional Capacity for the Management of POPs in Ghana

Total Cost of Project: US\$190,300

Duration of Project: 2 Years

1.0 Project Matrix

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATIONS	IMPORTANT ASSUMPTIONS
Goal			
Improve the management of risks to human health and the environment from POPs	<ul style="list-style-type: none"> Policy makers and general public aware of risks of POPs 	<ul style="list-style-type: none"> Media reports and commentaries on POPs Public complaints on POPs Industrial agitations against POPs 	Risk of POPs exists in the environment
Purpose			Purpose to Goal
To strengthen human and institutional capacity for the management of POPs in Ghana.	<ul style="list-style-type: none"> A multi-sectoral approach to the management of POPs in place Compliance & enforcement networks 	<ul style="list-style-type: none"> Reports of collaborating institutions Project reports Existence of collaborating institutions 	Relevant institutions cooperate
Outputs			Output to Purpose
<ul style="list-style-type: none"> Guidelines for the safe and environmentally sound production, usage, transportation, storage, handling and disposal of POPs and POPs containing equipment developed. Policy and legislation for the management and control of POPs developed. Capacities developed in relevant institutions for the management of POPs. Coordination of activities of relevant institutions on POPs promoted 	<ul style="list-style-type: none"> Number of guidelines produced Policy document and legal instruments developed 	Guidelines, laws and policy documents	Documents would be utilized
Indicative Activities	Inputs		Activity to Output
<ul style="list-style-type: none"> Conduct education and create awareness among policy makers and the general public on the risks posed by POPs. Train staff in relevant institutions in the management and control of POPs. Formulate policy on POPs Develop legislation for the management and control of POPs Train staff of judiciary and other law enforcement agencies on enforcement of legislation on POPs Coordinate activities of relevant institutions on POPs 	<ul style="list-style-type: none"> Training materials (manuals, flyers, brochures) Hiring of conference facilities Resource persons Technical assistance Transportation 	Reports of meetings and training workshops	Commitment of personnel in implementation of project activities

2.0 Project Purpose

The goal of the project is to improve the management of risks to human health and the environment from POPs and the purpose is to strengthen human and institutional capacity for the management of POPs in Ghana.

3.0 Indicative Activities

The activities to be conducted under the project include the following:

- Conduct education and create awareness among policy makers and the general public on the risks posed by POPs.
- Train staff in relevant institutions in the management and control of POPs.
- Formulate policy on POPs
- Develop legislation for the management and control of POPs
- Train staff of judiciary and other law enforcement agencies on enforcement of legislation on POPs
- Coordinate activities of relevant institutions on POPs

4.0 Outputs

The outputs of the proposed project include the following:

- Guidelines for the safe and environmentally sound production, usage, transportation, storage, handling and disposal of POPs and POPs containing equipment developed.
- Policy and legislation for the management and control of POPs developed.
- Capacities developed in relevant institutions for the management of POPs.
- Coordination of activities of relevant institutions on POPs promoted

5.0 Beneficiaries

The immediate and Long-term beneficiaries of this proposal include:

- Regulatory Institutions (EPA, CEPS, Ministry of Trade and Industry, Ghana Standards Board, Ghana Atomic Energy Commission etc.).
- Research and training Institutions – Council for Scientific and Industrial Research, Cocoa Research Institute of Ghana, the Universities and Specialised Training Institutes).
- User Institutions - Extension Officers of the Ministry of Food and Agriculture, Farmer Associations, Industries, VRA, ECG).
- Emergency Response Institutions and Poison Centres - Hospitals, Biomedical Labs, the Police, Army, fire Service, Red Cross and National Disaster Management Organisation.

6.0 Financial Statement

Component	Number of Units	Unit Cost (USD)	Total Cost (USD)
Administration and coordinating mechanism			
Personnel	2 years	15,000	30,000
Administrative expenses	2 years	1,000	24,000
Local and international travels			18,000
Equipment			25,000
Component total			97,000
Guidelines development			
Technical assistance (local)	6 work-months	2,500	15,000
Technical assistance (international)	30 work-days	500	15,000
Stakeholder consultations	30 participants	170	5,100
Document production			1,000
Component total			36,100
Development of policy and legislation			
Technical assistance (local)	2X6 man-months	2,500	30,000
Technical assistance (international)	30 workdays	500	15,000
Stakeholder consultation workshops	30 participants	170	5,100
Component total			57,200
Grand Total			190,300

**Project Proposal on Capacity Development for the Identification, Analysis and Monitoring of POPs
in Ghana**

Total Cost of Project:

US\$3,218,000

Duration of Project:

5 Years

1.0 Project Matrix

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATIONS	IMPORTANT ASSUMPTIONS
Goal			
Improve the management of risks to human health and the environment from POPs	Level of contamination of the environment by POPs determined	Analytical equipment, trained staff, monitoring reports	Risk of POPs exists in the environment
Purpose			Purpose to Goal
To develop capacity and capability for the identification, analysis and monitoring of POPs in the environment.	Facilities for the identification and analysis of POPs established and in operation	<ul style="list-style-type: none"> • Frequency of monitoring reports • Laboratory staff establishment records 	<ul style="list-style-type: none"> • Right policies are in place. • Sustainable source of funding for the laboratories is in place. • Trained staff remain at post.
Outputs			Output to Purpose
<ul style="list-style-type: none"> • Analytical equipment for analysing POPs acquired • Staff trained to run laboratories • Levels of POPs in the environment and assessed. 	<ul style="list-style-type: none"> • At least two existing laboratories upgraded to analyse POPs • At least 7 professional staff trained to work in each laboratory 	<ul style="list-style-type: none"> • Frequency and quality of reports and publications 	<ul style="list-style-type: none"> • There are laboratories with flexible mandate to accommodate this project
Indicative Activities	Inputs		Activity to Output
<ul style="list-style-type: none"> • Identify laboratories to be upgraded • Procure equipment and other inputs • Upgrade physical infrastructure • Recruit and train staff • Analyse POPs in the environment and POPs-containing equipment 	<ul style="list-style-type: none"> • Existing laboratories with appropriate physical infrastructure • Analytical equipment • Technical assistance • Training costs • Consumables • Transportation 	Reports	Trained staff remain at post.

2.0 Background Information

2.1 Situation

Aware of the increasing threat to human health and the environment, the Governing Council of the United Nations Environment Programme (UNEP) in May 1995, in its decision 18/32 requested that an international assessment process be undertaken of an initial list of 12 Persistent Organic Pollutants (POPs), including aldrin, chlordane, DDT, dieldrin, dioxins, furans, hexachlorobenzene, heptachlor, mirex, Polychlorinated Biphenyls (PCBs) and toxaphene).

Ghana is under obligation, with support from GEF/UNIDO to ensure the elimination of PCBs in equipment that are in use or stockpiled. The main equipment of interest in this matter are transformers, capacitors and other receptacles containing liquid stocks by 2025, subject to review of the Conference of Parties.

As a first step, an inventory on production, export, import, use and distribution of POPs (PCBs, POPs Pesticides, Dioxins and Furans) was recently (2003) carried out by a team drawn from the Environmental Protection Agency (EPA) as well as other institutions (National Nuclear Research Institute, University of Science and Technology, Volta River Authority and Electricity Company of Ghana).

2.2 Recent Assessment

The assessment revealed that POPs pesticides and PCBs are not produced in Ghana. PCB containing-equipment were however found in industrial facilities, residential and commercial buildings and electricity distribution networks. POPs pesticides are also included in the over 72 tonnes of obsolete stocks of pesticides in various locations throughout the country. The assessment also revealed emissions of dioxins and furans from various sources in the country. The main applications of PCBs at the target locations were in transformers and capacitors belonging to the Electricity Company of Ghana and the Volta River Authority and their clients. Detailed scientific analyses of the contents of transformers and capacitors are required to establish their concentration.

The research revealed the following with regards to PCB containing equipment:

- There are 455 pre-1972 possible PCB-containing transformers countrywide.
- PCB oils in samples of the identified transformers had concentrations <100ppm.
- 147 pieces of 33KVA PCB containing transformers have been decommissioned and stored at the Achimota Power Station, Accra Central Station-G and VRA materials store at Tema.
- Some of the capacitors had breaks at the insulator.
- Many of the decommissioned transformers had serious leaks.

2.3 Institutional Aspects

The identification and analysis of POPs requires specialised analytical equipment, appropriate physical laboratory infrastructure, high level of operator competence and quality assurance and control systems. The EPA which is co-ordinating the enabling activities does not have a laboratory capable of analysing PCBs. However it could co-ordinate the research programme because of familiarity with various task objectives.

The capabilities of twenty (20) analytical laboratories have been assessed in terms of their POPs analytical potentials and only five (5) were found to be capable of upgrading for analysing POPs. Personnel to be involved in the programme would need some form of training and attachment with experienced laboratories. Whichever laboratory will eventually be selected to undertake the research would have to be properly assessed and upgraded to enable it meet the demands of the task. Eventually, however, international assistance is required to ensure that the complete cycle of activities identified under section 4.0 are successful.

2.4 Current Programmes for Sustainability the POPs Project

Ghana ratified the Stockholm Convention on POPs on 30th May 2003 and is bound to implement protocols that would minimise environmental and human risks to POPs. Currently Ghana EPA is co-ordinating a project titled “Enabling Activities to Facilitate Early Action on the Implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Ghana”. The obligations under this project are the main driving force that would ensure the success of the implementation of this current project. The co-ordinating institution, EPA is also implementing agency for the Pesticides Control and Management Act, 1996 (Act 548). A lot of experience has been gained over the years in implementation of aspects of this legislation that would impact positively on the proposed project.

This project would also benefit from the output of at least four (4) other proposed projects that in addition to the identification and analysis of POPs are being developed and whose implementation will help address a number of national priorities.

These projects include strengthening institutional capacity for the management of POPs, assessment of environmental and health effects of POPs and their alternatives, disposal of obsolete stocks of POPs and development of chemical information networks.

3.0 Project Goal and Purpose

The main goal of the project is to improve the management of risks to human health and the environment from POPs and the purpose is to develop capacity and capability for the identification, analysis and monitoring of POPs in the environment.

4.0 Project Outputs

The project outputs include the following:

- Analytical equipment for analysing POPs acquired
- Staff trained to run laboratories
- Levels of POPs in the environment and assessed

5.0 Indicative Activities

- Identify laboratories to be upgraded
- Procure equipment and other inputs
- Upgrade physical infrastructure
- Recruit and train staff
- Analyse POPs in the environment and POPs-containing equipment

6.0 Beneficiaries

- Direct benefits of successful implementation will go to the Government of Ghana being party to the Convention on POPs.
- Institutions (VRA and ECG) that have stockpiles and in-use equipment that contain significant PCB oils would benefit from disposal of such hazardous materials from their premises;
- The entire population of Ghana, and in particular people whose businesses are located around depots of stashed equipment.

7.0 Risks and Assumptions

The success of this programme depends on an efficient laboratory and competent personnel. There is also need for financial support under GEF/UNIDO. Relevant information, technical and administrative

support should be provided by the EPA, which is co-ordinating, the entire enabling activities. Co-operation from all stakeholder institutions that participated in the preliminary assessment would be very essential as experiences gained will be indispensable in this project.

8.0 Financial Summary

It would cost an estimated amount of USD 3,218,000 to carry out the proposed project and a summary of the budget is presented in the Table below.

Component	Name of units	Number of Units	Unit Cost (USD)	Total Cost (USD)
Administration and coordinating mechanism	Years	5	80,000	400,000
Equipment (analytical equipment, computers, software)				585,000
Sample collection and analysis				2,000,000
Upgrading physical infrastructure of laboratories	Laboratories	2	25,000	50,000
Training on sample collection, preservation, analytical techniques and laboratory management	Laboratory staff	14	7,000	98,000
Vehicles	Pick-up trucks	2	30,000	60,000
Reporting, communication and printing				30,000
Total				3,218,000

Project Proposal on Development of Information and Communication System for the Management of POPs in Ghana

Total Cost of Project:

US\$133,100

Duration of Project:

1 Year

1.0 Project Matrix

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATIONS	IMPORTANT ASSUMPTIONS
Goal			
Improve the management of risks to human health and the environment from POPs	<ul style="list-style-type: none"> Risks to human and the environment from POPs reduced. 	<ul style="list-style-type: none"> Medical records Monitoring results Reports from poison centres 	Risk of POPs exists in the environment
Purpose			Purpose to Goal
To develop and implement information and communication system for the management of POPs.	<ul style="list-style-type: none"> Relevant stakeholders have easy access to adequate information on POPs. 	<ul style="list-style-type: none"> Reports from stakeholder institutions. Media reports 	Information is utilized to change perceptions and attitudes on POPs.
Outputs			Output to Purpose
<ul style="list-style-type: none"> National data and information centre on POPs established. Communication strategy formulated and implemented. Networking among stakeholders at the national and international levels promoted. Poison information and management centres established. 	<ul style="list-style-type: none"> Number of stakeholders connected to network. At least ten (10) poison centers established. Number and frequency of publications released Meetings of stakeholders. 	<ul style="list-style-type: none"> Reports of meetings, workshops. Data storage and retrieval systems 	<ul style="list-style-type: none"> Data and information would be utilized. Enabling policy environment.
Indicative Activities	Inputs		Activity to Output
<ul style="list-style-type: none"> Sensitise relevant stakeholders and conduct information needs assessment. Assess public participation and perception on public health and environmental risks of POPs. Identify sources of data and information on POPs. Prepare register of national experts and infrastructure for management of POPs. Establish centres for data management and dissemination on POPs. Establish poison information and management centres. Develop website for exchange of information. Train stakeholders on the operation and management of the information system. Hold fora to exchange information and experiences on POPs management. Issue periodic publications. 	<ul style="list-style-type: none"> Information and communication equipment (hardware and software) Technical assistance Stationery Hiring of conference facilities Resource persons 	<ul style="list-style-type: none"> Reports Active website Periodic publications on POPs 	<ul style="list-style-type: none"> Commitment of personnel in implementation of project activities.

2.0 Background Information

Access to the wealth of information on chemicals and pesticides is critical to building capacity for the sound management of chemicals as called for in Chapter 19 of Agenda 21. The Intergovernmental Forum on Chemical Safety noted in its Bahia Declaration and Priorities for Action Beyond 2000 the importance of eliminating barriers to information exchange for the sound management of chemicals in order to enhance communication among national, sub-regional, regional and international stakeholders.

This proposed project on the development and implementation of a chemicals information and communication system acknowledges that information and communication technology including the Internet is an important tool for strengthening the capacity of countries to manage chemicals, as it will provide a gateway to valuable scientific, technical, economic, and legal information. In particular, access to this information will facilitate implementation of chemicals-related treaties such as the Stockholm, Rotterdam and Basel Conventions.

The project, which aims at establishing chemicals information centres at EPA and Poison Control and information centres in Ghana is in line with the Stockholm Convention on Persistent Organic Pollutants (POPs), which Ghana has ratified.

2.1 Situation

Ghana recognises that over a long period of time it has been using chemicals and pesticides, including Persistent Organic Pollutants (POPs). The 12 initial POPs include eight pesticides (Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Mirex, and Toxaphene), two industrial chemicals (PCBs and Hexachlorobenzene, also a pesticide) and two unwanted by-products of combustion and industrial processes (dioxins and furans).

The main uses of chemicals and pesticides in Ghana are for agriculture, public health and manufacturing industries with agriculture engaging about 65% of the workforce. The cocoa industry is the greatest user of agricultural chemicals. The general effects of chemicals include poisoning of the consuming public through the consumption of food, game and fish caught via chemical application. The fact that these chemicals are cancerous, dangerous and cause acute health problems present challenges to responsible agencies to put relevant structures in place to reduce and eliminate POPs.

2.2 Recent Assessment

In recent past, the Chemicals Control and Management Centre (CCMC) of Environmental Protection Agency (EPA) has embarked on a programme to study the extent of the proliferation of the dangerous chemicals with a view to control and manage them in an environmentally sound manner. The search covers chemical dealers, farmers sprayers etc. Through the POPs enabling activities project the following areas have been covered.

- Stockpiles, contaminated sites and wastes
- Assessment of POPs pesticides
- Assessment of POPs industrial chemicals
- Assessment of unintentional releases of POPs (Dioxins, Furans, HCB and PCBs)

2.3 Institutional Aspects

The Chemicals Control and Management Centre of the EPA has operationalised the Pesticides Control and Management Act, 1996 (Act 528), which involves the registration of pesticide products and licensing of pesticide dealers. The Centre has considerable experience in chemicals control and management and appropriate structures are being developed and strengthened throughout the country to improve monitoring and data collection. The Centre requires training and logistics to become well equipped for the task ahead.

In Ghana POPs have been used but now that they are banned people will have problems. Fortunately however, there are alternatives to most POPs. The problem is the high costs, a lack of public awareness, and the absence of appropriate infrastructure and technologies, which often prevent their adoption. Solutions must however be tailored to the specific properties and uses of each chemical, as well as to each country's climatic and socio-economic conditions.

2.4 Current programme for sustainability of project

The Agency has for a long time been handling issues concerning chemicals but there are other institutions that are also stakeholders. It is expected that at the end of the project the trained officers will continue to do the work. Furthermore these officers are already on government salary hence sustainability is assured.

3.0 Project Purpose

The main purpose of the project is to develop and implement information and communication system for the management of POPs.

4.0 Activities to be conducted

- Sensitise relevant stakeholders and conduct information needs assessment.
- Assess public participation and perception on public health and environmental risks of POPs.
- Identify sources of data and information on POPs.
- Prepare register of national experts and infrastructure for management of POPs.
- Establish centres for data management and dissemination on POPs.
- Establish poison information and management centres.
- Develop website for exchange of information.
- Train stakeholders on the operation and management of the information system.
- Hold fora to exchange information and experiences on POPs management.
- Issue periodic publications.

5.0 Outputs

- National data and information centre on POPs established.
- Communication strategy formulated and implemented.
- Networking among stakeholders at the national and international levels promoted.
- Poison information and management centres established.

The database is expected to contain elements including the following:

- List of chemical sellers

- Types of chemicals sold
- Methods of disposal
- Uses of chemical
- Quantities imported
- Creation of an interactive website among the regional office and

6.0 Beneficiaries

The main beneficiaries of the project include: Chemical Sellers, EPA, Hospitals, Customs Excise and Preventive Service (CEPS), Association of Ghana Industries, Farmers, VRA, ECG and the general public.

7.0 Financial Summary

Component	Number of Units	Unit Cost (USD)	Total Cost (USD)
Administration and coordinating mechanism			
Personnel	12 work-months	2,000	24,000
Administrative expenses	12 months	1,000	6,000
Local and international travels			7,000
Component total			37,000
Equipping information Centre at EPA			
Computers and accessories	23	1,500	34,000
Upgrading server			10,000
Radio equipment and installation			10,000
Internet connectivity and subscription fees	10	1,200	12,000
Component total			66,000
Development of database programme			
Technical assistance			20,000
Training workshops for information support staff personnel			5,000
Training workshops for information support staff and stakeholders on use of database	30 participants	170	5,100
Component total			30,100
Grand Total			133,100

Project Proposal for the Investigation and Assessment of Health Effects of POPs in Ghana

Total Cost of Project:

US\$347,200

Duration of Project:

2 Years

1.0 Project Matrix

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATIONS	IMPORTANT ASSUMPTIONS
Goal			
<p>Improve the management of risks to human health and the environment from POPs</p> <p>To protect human health and the environment from the harmful effects of POPs</p>	<ul style="list-style-type: none"> The use and releases of POPs reduced and /or eliminated Levels and severity of health effects of POPs exposure reduced Safe alternatives for POPs identified and used 	<ul style="list-style-type: none"> Annual POPs inventory reports Medical surveillance reports Poison Control and Information Centre statistics 	
Purpose			Purpose to Goal
Investigate and assess the nature and severity of health effects experienced by humans as a result of exposure to Persistent Organic Pollutants (POPs)	<ul style="list-style-type: none"> Initial compilation report on the types, sources and releases of POPs into the environment submitted Number, groups and locations of persons identified as high risk groups to POPs exposure documented Statistics and reports on medical surveillance Nature and severity of health effects experience of high risk groups estimated 	<ul style="list-style-type: none"> Initial data compilation report Records on persons at risk to POPs exposure Medical surveillance statistics and reports Risk characterisation report 	<ul style="list-style-type: none"> Persons exposed to POPs pesticides, which were banned in 1985 can be identified and included in the research The willingness of persons at risk to POPs exposure to take part in the research
Outputs			Output to Purpose
<ul style="list-style-type: none"> Nature and severity of health effects experienced by high risk groups estimated Opportunities for management interventions required to reduce identified adverse effects and risks to acceptable levels recommended Capacity of health centres to handle POPs poisoning strengthened 	<ul style="list-style-type: none"> Health threats posed by persons at risk to POPs exposure estimated Management interventions required to reduce adverse effects of POPs exposure identified and implemented Information on the handling of POPs poisoning made available to all Health Centres in risk locations 	<ul style="list-style-type: none"> Project Implementation report Epidemiological study/medical surveillance report Post project monitoring report 	Findings of the research made available to Health Centres
Indicative Activities	Inputs		Activity to Output
<ul style="list-style-type: none"> Review and collate data on the types, sources and releases of POPs Review and collate data on previous toxicological (human and animals) and epidemiological studies. Determination of the routes of human exposure to POPs Identify high risk groups and 	<ul style="list-style-type: none"> Medical Officers, Laboratory technicians/Nurses, protect staff, epidemiological experts Well equipped laboratory; equipment for measuring POPs in blood and breast milk; Computer models; USD347,200 		

<p>conduct monitoring and medical surveillance</p> <ul style="list-style-type: none"> ● Collection and analysis of blood and breast milk samples from identified risk groups ● Conduct health/medical surveillance on the sample population ● Estimate the nature and severity of health effects of POPs on the exposed population. 			
--	--	--	--

2.0 Background

2.1 Situation

Over the last 100 years, the production and use of chemicals have grown remarkably and chemical substances have become an integral part of our lives in areas like public health, agriculture and industrial processes. While there are substantial benefits from the use of chemicals in many areas, their use and misuse at any stage in their life cycle can cause adverse effects on human health and the environment. Out of about one hundred thousand chemicals in commercial use, twenty thousand (20,000) are said to be potentially dangerous and two thousand five hundred (2500) have been officially evaluated and classified as dangerous.

Persistent Organic Chemicals (POPs) are among the most dangerous pollutants released into the environment by man-made activities. They are extremely stable and therefore can be transported over long distances in the atmosphere, resulting in widespread distribution across the earth, including regions where they have never been used.

POPs are highly toxic pollutants that are persistent in the environment; accumulate in high concentrations in fatty tissues and can cause an array of adverse effects on both humans and animals. Scientific evidence has shown that exposure to even low doses of certain POPs can *cause* cancer, allergies, hypersensitivity, damage to the central and peripheral nervous systems, reproductive disorders, disruption of the immune system, birth defects and even death.

Due to these significant threats posed by POPs to human health and the environment, the international community met in Sweden on 22 May 2001 and adopted an international treaty aimed at restricting and ultimately eliminating production, use, release and storage of POPs.

The main objective of the Stockholm Convention is to protect human health and the environment from the harmful effects of POPs. Ghana became a party to the convention on the 22 May 2001 and ratified the Convention on the 30 May 2003. The Convention focuses on reducing and eliminating releases of 12 of the most dangerous POPs. These "Dirty Dozen" include eight pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene), two industrial chemicals (polychlorinated biphenyls (PC13s) and Hexachlorobenzene), and two bi-products (polychlorinated dibenzo-p-dioxins and dibenzofurans).

A recent preliminary inventory carried out to facilitate early action on the Stockholm Convention in the country revealed that Ghana has imported and used POP pesticides and the two POPs industrial chemicals in the past. Dioxins and furans are generated as by-products of varied combustion processes of various industrial processes and human activities.

The inventory also revealed that although there are no available data on the quantities of POPs pesticides imported in the past, there are reports of organochlorine pesticides poisoning of which a majority are listed as POPs from analysis conducted by the forensic science laboratory of the Ghana Standards Board in collaboration with the Department of Pathology at the University of Ghana Medical School.

Unfortunately, no holistic risk assessment (epidemiological study) has been carried out to examine the nature and severity of human health threats posed by exposure to POPs. The present project therefore proposes a comprehensive scientifically based assessment of the human health threats posed by POPs exposure through the identification of the causes underlying detrimental effects and risks posed by these chemicals.

2.2 Recent Assessment

Subsequent to becoming a signatory to the Convention, Ghana in accordance with Article 7 of the Convention initiated a programme to prepare National Implementation Plans (NIPs) and to assess the country's capacity to implement these plans. As part of the National Implementation Plan preparation, a preliminary inventory at POPs was carried out to facilitate early action on the implementation of the Stockholm Convention. The inventory revealed the following:

- POPs pesticides and industrial POPs have never been produced in Ghana, though they were imported for various uses before being banned in 1985. Since then the use of POPs pesticides have declined substantially;
- Dioxins and Furans are produced unintentionally by various industrial and domestic activities that include: uncontrolled combustion processes, medical incineration and power generation/heating and transport. In 2002, a total of 386gI-TEQ of PCDD/PCDF was emitted from known sources in Ghana;
- The Electricity Company of Ghana (ECG) and the Volta River Authority (VRA)-the main users of transformers and capacitors officially ceased importing PCB-containing transformers and capacitors for use in Ghana in 1972. Currently, there are 455 pre-1972 possible PCB- containing transformers and 147 pieces of 33KVA possible PCB-containing capacitors countrywide;
- Two groups of people are at risk to POPs exposure, i.e. occupational and non-occupational exposure. Exposures in both cases could be either accidental or deliberate:
- The vulnerable groups include wholesalers and retailers of pesticides; users, farm workers; adults and children at homes where pesticides are stored, and the general public;
- ECG and VRA technicians responsible for the servicing and maintenance of PCB- containing transformers and capacitors are at risk to the adverse effects of PCB exposure;
- There is a need to research into medical surveillance among POPs users to determine the presence, levels and trends of POPs exposure in humans;
- In areas of dioxin and furan releases, vulnerable groups are taking no special precautions. There is therefore an urgent need for sensitisation at both the individual and institutional levels if preventive measures are to be effective;

2.3 Institutional Aspects

The Environmental Protection Agency (EPA) is the national institution charged with the responsibility to control the importation and use of all chemicals including POPs. A Chemicals Control and Management Centre (CCMC) have been created within the EPA to control and manage chemical imports into the country.

The work of the CCMC is supported by three Committees constituted to ensure multi-sectoral collaboration in the control and management of chemicals (including POPs) in Ghana. The committees are: the Hazardous Chemicals Committee, Pesticides Technical Committee and the National Coordinating Team on Persistent Organic Pollutants.

With the EPA as the coordinating Centre, Ministries, Departments and Agencies (MDAs) such as the Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture, the Ghana Standards Board, the Ghana Atomic Energy Commission, the Customs, Excise and Preventive Service, the Minerals Commission, the Ministry of Health/Ghana Health Service, the Food and Drugs Board, NGOs and the Universities and Research Institutions participate in committee meetings aimed at ensuring the sound management of chemicals including POPs in the country.

In 2002, a POPs Project Secretariat was established within the Environmental Protection Agency to facilitate the preparation of National Implementation Plan and the implementation of programmes to reduce and eliminate POPs in Ghana. The Office with financial and technical assistance from the United Nations Industrial Development Organisation (UNIDO) and the Global Environmental Facility (GEF) is responsible for the implementation of the Enabling Activities Project in Ghana.

2.5.3 Poison Control and Information Centre

The Centre was established by the Ministry of Health/Ghana Health Service to assist health professionals with the needed information to diagnose and treat cases of poisoning from chemicals including POPs.

2.5.4 Programmes Implemented under the Stockholm Convention

Ghana with financial and technical support from the UNIDO and GEF has initiated a series of activities to assess the capacity of the country to implement provisions of the convention. A preliminary inventory on POPs has already been carried out to facilitate early action on the implementation of the convention, other actions being implemented include:

- Development of proposals to address national priorities identified in the Preliminary inventory report
- Identification of management options and the need for the introduction of new technologies
- Assessment of cost and benefits of management studies

3.0 Project Objectives

The primary objective of the project is to investigate and assess the extent and severity of health effects experienced by humans exposed to Persistent Organic Pollutants (POPs). The specific objectives include:

- Identify/assess the types, sources and releases of Persistent Organic Pollutants (both intentional and unintentional) into the environment
- Identify groups at risk to POPs exposure (occupational and non occupational)
- Review data and information on the existing toxicological (human and animal) studies as well as, where available, epidemiological information on health effects of POPs exposure
- Monitor the levels of POPs in the blood and breast milk (for breastfeeding mothers) in identified subjects to establish an exposure distribution
- Conduct health/medical surveillance on subjects (both occupational and non occupational) to

- establish a dose -response relationship
- Estimate using models the nature and severity of health threats posed by human exposure to POPs
- Identify opportunities for preventive and management interventions required to reduce identified adverse effects and risks to acceptable levels

4.0 Indicative Activities

The proposed project will investigate the health effects of POPs exposure in Ghana and therefore provide guidance concerning priorities for future curative and preventive action on the threats posed by POPs. Activities to be implemented are summarized as follows:

4.1 *Compilation of data on the types, sources and routes of releases of P013s; (both intentional and accidental) into the environment*

As part of the National Implementation Plan preparation the EPA together with other stakeholders carried out a preliminary inventory. Information on the type, sources and releases of POPs into the environment will be collated through the review of.

- The National preliminary inventory report prepared as part of the Ghana's programme to meet the provisions of the Stockholm Convention
- Existing data on the types, sources and releases of POPs into the environment
- Previous and ongoing research, and studies conducted by Universities, Research and other Institutions

4.2 *Assessment of health threats posed by POPs exposure*

Persistent chemicals like POPs have serious and widespread human and ecological consequences. A recent survey carried out by the EPA as part of revealed that no holistic health surveillance has been carried out to assess .the vulnerability of high-risk groups (occupational and non occupational) to POPs exposure. It is therefore important to investigate and assess the scale of threats posed by POPs to humans. The following activities will be undertaken:

- Identify high-risk groups through the review of existing and ongoing research and administration of questionnaires
- Determine the routes of human exposure to POPs
- Identify gaps in previous POPs related epidemiological studies and reported cases of POPs poisoning at hospitals in identified risk locations and the Poison Information Centre in Accra
- Determine sample size for study (between 200- 500 subjects)
- Collect and analyse blood and breast milk samples from identified risk groups
- Conduct health/medical surveillance on the sample population
- Develop modelling approaches for the assessment of exposure and risk posed by POPs to identified high risk groups
- Estimate the nature and severity of health effects of POPs on the exposed population
- Identify opportunities for management interventions required to reduce identified adverse effects and risks to acceptable levels

5.0 Outputs

The expected outputs of the project will include:

- Data on, the types, sources and releases of POPs into the environment collated
- Data and other gaps in the information available on the health effects of POPs established.

- High risk groups identified and sample population (subjects) determined
- Levels and trends of POPs in subjects determined
- Medical surveillance carried out on the sample population to establish a dose -response relationship
- Nature and severity of the health effects experienced by sample population to POPs exposure assessed
- Management and preventive interventions required to reduce identified adverse effects and risks to acceptable levels recommended

6.0 Beneficiaries

The beneficiaries of the proposed project will include key Government Institutions and persons at risk to POPs exposure.

- The Environmental Protection Agency, Ministry of Food and Agriculture, Ministry of Health, Ghana Health Service, Electricity Company of Ghana, Volta River Authority and other stakeholders involved in the, sound management of chemicals will benefit from the project.
- Other beneficiaries include persons at risk to the health effects of POPs, i.e. farmers, persons exposed to PCB oils and dioxins and furans and the general public

7.0 Risk and Assumptions

The first risk to the project is that, some persons identified, as subjects for the epidemiological study may be unwilling to allow their blood samples to be taken and/or to go through the medical surveillance. It is believed that the project team will be able to sensitise and counsel the identify subjects on the relevance of the project before sampling.

The second risk to the project may be the identification of persons exposed to POPs pesticides, which was banned in Ghana as far back as 1985. This risk is however minimised because of the availability of data on the areas were POPs pesticides were used in the past.

However, the effective implementation of the project will depend on the availability of financial and technical (equipment and expertise) support to ensure timely implementation of the project.

8.0 Financial Summary

Component	Number of Units	Unit Cost (USD)	Total Cost (USD)
Administration and coordinating mechanism			
Personnel	12 work-months	4,000	48,000
Administrative expenses	12 months	2,000	24,000
Local and international travels			15,000
Component total			87,000
Training and sensitisation workshops			
Sensitization workshop	30 participants	170	5,100
Training workshop	30 participants	170	5,100
Component total			10,200
Medical surveillance			
Sampling and analysis			250,000
Component total			250,000

National Implementation Plan – Ghana

Grand Total			347,200
-------------	--	--	---------

Project Proposal for the Safe and Environmentally Sound Disposal of POPs in Ghana

Total Cost of Project:

US\$3,825,000

Duration of Project:

5 Years

1.0 Project Matrix

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATIONS	IMPORTANT ASSUMPTIONS
Goal			
Improve the management of risks to human health and the environment from POPs	<ul style="list-style-type: none"> Risks to human and the environment from POPs reduced. 	<ul style="list-style-type: none"> Medical records Monitoring results 	Risk of POPs exists in the environment
Purpose			Purpose to Goal
To undertake safe and environmentally sound treatment and disposal of POPs, POPs-laden equipment and remediation of contaminated sites.	<ul style="list-style-type: none"> Quantity of POPs and POPs-laden equipment disposed 	<ul style="list-style-type: none"> Disposal permits issued Reports 	<ul style="list-style-type: none"> Conducive policy environment General public aware of risks of POPs
Outputs			Output to Purpose
<ul style="list-style-type: none"> Capabilities of line institutions and for the safe and environmentally sound collection, transportation and storage of POPs enhanced. Private sector participation in the safe and environmentally sound collection, transportation, storage, treatment and disposal of POPs promoted. Facilities for the SES storage and disposal of existing POPs pesticides and POPs-containing equipment identified and rehabilitated and/or redesigned. Procedures for the safe and environmentally sound treatment and disposal of POPs pesticides, PCBs and PCPs-containing equipment developed. Treatment and disposal of existing stockpiles of PCP-containing equipment, POPs pesticides conducted. 	<ul style="list-style-type: none"> Number of private sector operators involved in SES collection, treatment and disposal of POPs Number of functional facilities for SES storage and disposal of POPs. 	<ul style="list-style-type: none"> Reports Manual of procedures 	<ul style="list-style-type: none"> Enabling policy and economic environment
Indicative Activities	Inputs		Activity to Output
<ul style="list-style-type: none"> Conduct survey of institutional capabilities of VRA and ECG and other relevant agencies for the SES collection, transportation and storage of POPs and obsolete POPs-containing equipment. Retool relevant institutions to effectively handle (collection, POPs/obsolete POPs-containing equipment. Conduct 6 workshops to sensitise and promote private sector participation in SES, management of POPs. Prepare BID documents for treatment and disposal of POPs. 	<ul style="list-style-type: none"> Technical assistance Specialized vehicles Four wheel-drive trucks Stationery Computer note pad Treatment and disposal costs. 	<ul style="list-style-type: none"> Reports Invoices and receipts. 	<ul style="list-style-type: none"> Stakeholder institutions collaborate

2.0 Background

Article 6 of the Stockholm Convention calls on country Parties to identify stockpiles, products, articles in use, and wastes containing or contaminated with POPs and to manage and dispose of such materials. They are to be "disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of POPs or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferred option or the persistent organic pollutant content is low."

Ghana, a Party to the treaty is implementing GEF/UNIDO project on enabling activities to facilitate early action on the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Ghana. The Environmental Protection Agency (EPA) is coordinating the project.

POPs including polychlorinated biphenyls (PCBs), dioxins, and furans have long been recognised as posing a threat to the environment because of their toxicity, persistence and tendency to bioaccumulate. Although the use of POPs has been reduced greatly since the 1970s when legislation was first sought to control their use and supply it is recognised that those still remaining as stockpiles and in existing equipment pose a continuing environmental threat.

Generally the sources of contaminated equipment are any equipment (including any transformer, capacitor or receptacle containing residual stocks), which contains POPs, or have contained POPs not decontaminated and exceeding defined permissible limits of about 0.05% (50ppm) for PCBs.

2.1 Recent Assessment

As part of the programme implementation, an emissions and contamination task team conducted a preliminary inventory of POPs. The team identified quantities of decommissioned capacitors suspected to contain PCB oils belonging to Electricity Company of Ghana (ECG) and the Volta River Authority (VRA) that needs immediate disposal. The deteriorated state poses potential risk/hazard to the workers of the company and the environment in general.

The report also indicates that the ECG and VRA lack the requisite expertise and logistics to undertake the disposal of such wastes. There is therefore the need for technical and financial assistance for the safe and environmentally sound disposal of POPs wastes.

The inventory further identified the existence of stockpiles of obsolete pesticides including POPs pesticides and a number of sites where pesticides are believed to have been buried. Such sites have been designated as contaminated sites because these pesticides were extensively used before the worldwide ban on the use of POPs have been enormously used in the country for a considerable period of time. In view of the potential health-related impacts, there is the urgent need for such sites to be decontaminated and also the environs properly monitored for residue.

2.2 Current programs for the Sustainability of the Disposal and Decontamination project

The proper management of hazardous wastes has been identified as major problem in Ghana. And the country has therefore initiated various actions to address the issue including the following:

2.2.1 Development of Hazardous Waste Management Guidelines

The EPA has developed a hazardous waste management strategy and guidelines under the Tema Export processing Zone (TEPZ) project funded by the World Bank and a best practice environmental guidelines for series 2 for management of health care waste in Ghana, including waste incineration. The TEPZ project would provide a waste incineration capacity for hazardous waste treatment.

2.2.2 Integration of PCBs decontamination technology in GCLME Demonstration project

Ghana is among 15 African countries participating in the UNEP/GEF/UNIDO project on the Gulf of Guinea Large Marine Ecosystem (GCLME), which starts in June 2004. Ghana's component includes a pilot demonstration project on waste oil recovery and recycling and this could integrate technology for the treatment of POPs wastes.

2.2.3 Pesticide control and management Act

The Government of Ghana enacted the Pesticides Control and Management Act, 1996 (Act 528) to control the importation, manufacture, distribution, storage and ultimate disposal of pesticides. Subsequently, the EPA established a Chemicals Control and Management Centre to coordinate chemicals management activities in Ghana, which includes registration, licensing and permitting.

3.0 Project Purpose

The purpose of the project is to improve the management of risks to human health and the environment from POPs:

4.0 Project Outputs

The project outputs include the following:

- Capabilities of line institutions and for the safe and environmentally sound collection, transportation and storage of POPs enhanced.
- Private sector participation in the safe and environmentally sound collection, transportation, storage, treatment and disposal of POPs promoted.
- Facilities for the safe and environmentally sound storage and disposal of existing POPs pesticides and POPs-containing equipment identified and rehabilitated and/or redesigned.
- Procedures for the safe and environmentally sound treatment and disposal of POPs pesticides, PCBs and PCPs-containing equipment developed.
- Treatment and disposal of existing stockpiles of PCP-containing equipment, POPs pesticides conducted.

5.0 Indicative Activities

The project activities include the following:

- Conduct survey of institutional capabilities of VRA and ECG and other relevant agencies for the safe and environmentally sound collection, transportation and storage of POPs wastes and obsolete POPs-containing equipment.
- Retool relevant institutions to effectively handle POPs obsolete POPs-containing equipment.
- Conduct 6 workshops to sensitise and promote private sector participation in safe and environmentally sound, management of POPs.
- Prepare BID documents for treatment and disposal of POPs.

6.0 Beneficiaries

- ECG, VRA, end users of POPs pesticides and POPs-containing equipment whose capacities will be built in handling, treatment and appropriate disposal of POPs wastes.

- Ghana would meet its obligations under the Stockholm Convention.

7.0 Financial Summary

Component	Name of units	Number of Units	Unit Cost (USD)	Total Cost (USD)
Administration and coordinating mechanism	Years	5	80,000	400,000
Conduct national survey and needs assessment of relevant institutions				585,000
Conduct workshops to sensitise and promote private sector participation in safe and environmentally sound, management of POPs	Workshops	6X50 participants	200	60,000
Upgrade infrastructure of facilities to store POPs wastes	Facilities	2	100,000	200,000
Equipment for relevant institutions and private operators for the safe and environmentally sound collection, transport and handling of POPs wastes				2,000,000
Collect and transport POPs wastes to storage facilities				500,000
Preparation of and evaluation of BID documents for the treatment and disposal of POPs wastes				50,000
Reporting, communication and printing				30,000
Total				3,825,000

In case of reply the number and date of this letter should be quoted

Telephone Accra:400303,400310,401343
Cables & Telegrams GHANAATOM
Telex: 2554 GAEC GH
Fax: 233-21-400807



REPUBLIC OF GHANA

GHANA ATOMIC ENERGY COMMISSION

P. O. LG.80
Legon-Accra

Our Ref:..... AG.35/VOL.VIII/128

Your Ref:.....

February 7 2007

The Executive Director
Environmental Protection Agency
P. O. Box M.326
Ministries Post Office
ACCRA



Dear Sir,

**ENDORSEMENT OF NATIONAL IMPLEMENTATION PLAN
BY NATIONAL STAKEHOLDERS**

Thank you for your letter of December 20, 2006 with Ref.: No. GC43/224/03/01 on the above subject.

I forward herewith the Stakeholders Endorsement Form duly signed for your attention and necessary action.

Yours faithfully,

PROF. E.H.K. AKAHO
DIRECTOR-GENERAL

③ BPO²
Kindly prepare
acknowledgement
of receipt letter
P/S MB, 15/2/07

② J/cmc.

Pf Mathurachin

MA
14/2/07

Encl.

Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs)

Stakeholders Endorsement Form

GHANA ATOMIC ENERGY COMMISSION.....

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 22ND 3 day of JANUARY.....2007

DIRECTOR GENERAL
Ghana Atomic Energy Commission
P. O. BOX LG 80
LEGON

Prof. E.H.K. AKAHO, DIRECTOR-GENERAL

Name, Signature and Position

In case of reply the number and date of this letter should be quoted

P. O. BOX 68
ACCRA.



REPUBLIC OF GHANA

My Ref. No. HCL/.....

Your Ref. No.

FEBRUARY 5, 2007

**THE EXECUTIVE DIRECTOR
ENVIRONMENTAL PROTECTION AGENCY
ACCRA.**



Dear Sir,

**ENDORSEMENT OF NATIONAL IMPLEMENTATION PLAN BY
NATIONAL STAKEHOLDERS**

Reference your letter GC 43/224/03/01 of 20/12/06 on above subject matter.

Please find attached the duly signed Stakeholders Endorsement form on the National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POP).

Thank you.

Yours faithfully,

**DINAH BRANDFUL (MRS.)
ASST. COMMISSIONER/LAB**

for Commissioner
**CUSTOMS, EXCISE & PREV. SERVICE
ASSISTANT COMMISSIONER
CUSTOMS LABORATORY**

② M/CCME
Pb Fyathu
Ba
05/02

③ PPO²
Kindly prepare
letter of
acknowledgement
PLS
2/2/07
6/2/07

**Ghana National Implementation Plan (NIP) of the Stockholm Convention on
Persistent Organic Pollutants (POPs)**

Stakeholders Endorsement Form

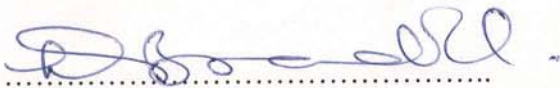
CUSTOMS EXCISE & PREVENTIVE SERVICE

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 22nd day of JANUARY 2007



Name, Signature and Position

DINAH BRANDFUL
ASSISTANT COMMISSIONER
CUSTOMS LABORATORY.

COCOA RESEARCH INSTITUTE OF GHANA

(A DIVISION OF COCOBOD)

Internal Mail

Post Office Box 8
Tafo - Akim
Ghana



External Mail

Private Mail Bag
Kotoka International Airport
Accra, Ghana

Office of the Executive Director

Ref. No. CRIG 27 vol 24/303

22nd January 2007

The Executive Director
Environmental Protection Agency (EPA)
P.O. Box M326
Ministries Post Office
Accra, Ghana



Dear Sir,

**ENDORSEMENT OF NATIONAL IMPLEMENTATION PLAN
BY STAKEHOLDERS**

I refer to your letter no. GC 43/224/03/01 dated 20th December 2006 on the above subject.

It is my pleasure to submit herewith a duly signed NIP endorsement form you sent to us.

Yours faithfully,

DR. YAW ADU-AMPOMAH
AG. EXECUTIVE DIRECTOR

③ PPO
Finals
30/1/07

② D/CCMC
Pb fyaa
02
30/01

**Ghana National Implementation Plan (NIP) of the Stockholm Convention on
Persistent Organic Pollutants (POPs)**

Stakeholders Endorsement Form

COCOA RESEARCH INSTITUTE OF GHANA


.....
Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 22nd day of JANUARY 2007

Dr YAW ADU-AMPOMAH
.....
Name, Signature and Position


Ag EXECUTIVE DIRECTOR

Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs)

Stakeholders Endorsement Form

DEPARTMENT OF FACTORIES INSPECTORATE

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this.....12TH.....day of.....JANUARY.....2007



ACTING CHIEF INSPECTOR OF FACTORIES.

Name, Signature and Position

ELECTRICITY COMPANY OF GHANA LTD.
ELECTRO - VOLTA HOUSE
P.O. BOX 521, ACCRA, GHANA



Tel: 676727/47
Telex: ECG. 2107GH
Fax: 233 - 21 - 666262
Cable: ECG. 050820
E-mail: ecgho@ghana.com

Our Ref. No. *msd/gen/v4/708*

Your Ref:

Date 25th January, 2007

The Executive Director,
Environmental Protection Agency,
P.O. Box M 326,
Accra.



Dear Sir,

**RE: ENDORSEMENT OF NATIONAL IMPLEMENTATION PLAN
BY NATIONAL STAKEHOLDERS**

Your letter reference GC43/224/03/01 dated 20th December 2006 on the above subject refers.

Please find attached the duly signed National Implementation Plan endorsement form for your further action.

Yours faithfully,

W.K. KYEREMATENG
DIVISIONAL MANAGER/REGULATORY & GOVT AFFAIRS
FOR MANAGING DIRECTOR

② J/cemc.

PP matter & action

25/1/07

*③ PPD²
kindly draft
letters to acknowledge
receipt of the endorsement
letters received so
far, pls
msd
30/1/07*

**Ghana National Implementation Plan (NIP) of the Stockholm Convention on
Persistent Organic Pollutants (POPs)**

Stakeholders Endorsement Form


ELECTRICITY COMPANY OF GHANA. LTD

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 23rd day of JANUARY 2007


Name, Signature and Position

Ing. A. T. Barfour
Director of Operations
Electricity Company of Ghana
Accra

Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs)

Stakeholders Endorsement Form

MINISTRY OF ENERGY

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 26 day of JANUARY 2007

J.B. OKAI
MINISTRY OF ENERGY
(J. B. OKAI)
DEPUTY DIRECTOR (PPME)

Name, Signature and Position

**Ghana National Implementation Plan (NIP) of the Stockholm Convention on
Persistent Organic Pollutants (POPs)**

Stakeholders Endorsement Form

MINISTRY OF ENERGY

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 26 day of JANUARY 2007

J.B. OKAI
MINISTRY OF ENERGY
(J. B. OKAI)
DEPUTY DIRECTOR (PPME)

Name, Signature and Position

**Ghana National Implementation Plan (NIP) of the Stockholm Convention on
Persistent Organic Pollutants (POPs)**

Stakeholders Endorsement Form

FRIENDS OF THE EARTH - GHANA

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this 18th day of JANUARY 2007

GEORGE Awuni

Name, Signature and Position

[Signature]

PROGRAMME COORDINATOR
for:

[Signature]
FRIENDS OF THE EARTH-GHANA
Private Mail Bag
General Post Office
Accra

In case of reply the number and date
of this letter should be quoted.



Occupational & Environmental
Health Unit
Ghana Health Service
P. O. Box 493
Accra.

My Ref. No.....

Your Ref. No.....

16th February, 2007.

**The Executive Director
EPA
Accra**



Dear Sir

ENDOSEMENT OF NATIONAL IMPLEMENTATION PLAN ON POPS

Please find attached the stakeholders Endorsement Form for the Ghana National Implementation Plan of the Stockholm Convention on Persistent Organic Pollutants, signed by our Director-General.

Yours sincerely

Dr. Edith Clarke
**Dr. Edith Clarke
Programme Manager
Occupational & Environmental Health Unit**

(2) D/CCMC

Pf. J. A. A. A. A. A.

*(3) PPO²
kindly prepare
acknowledgement
of receipt letter
of please ms
20/2/07*

19/2/07

Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs)

Stakeholders Endorsement Form

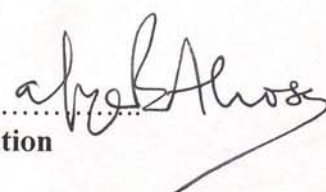
..... G H A N A H E A L T H S E R V I C E

Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this..... 14TH day of..... FEBRUARY 2007

Prof A B Anosa  DIRECTOR GENERAL
.....
Name, Signature and Position



GREEN EARTH ORGANIZATION

NGO in Special Consultative Status with the Economic and Social Council of the United Nations

Caring for the Earth



16th January, 2007.

The Executive Director
Environmental Protection Agency (EPA)
Accra

Dear Sir,

ENDORSEMENT OF NATIONAL IMPLEMENTATION PLAN BY NATIONAL STAKEHOLDERS

I wish to present to you, signed Stakeholders Endorsement Form from Green Earth Organization (GEO).

Sincerely,

George Ahadzie
Executive Director

D/CCMC
P/Management action
JAH
16/1/07

Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs)

Stakeholders Endorsement Form


GREEN EARTH ORGANIZATION

.....
Name of Institution

Having participated in the preparation of the Ghana National Implementation Plan (NIP) of the Stockholm Convention on Persistent Organic Pollutants (POPs) and the final review workshop held on 4th November 2004, agree to endorse the NIP document which would serve as the national blue print for the sound management of POPs in Ghana.

We further recognise that the effective and successful implementation of the Ghana NIP would depend on the active participation of broad-based relevant national stakeholders and therefore pledge our support.

Signed this.....16.....day of.....JANUARY.....2007


GEORGE AHADZIE
.....
Name, Signature and Position EXEC. DIRECTOR.

GREEN EARTH ORGANIZATION
P. O. BOX 15641
ACCRA-NORTH
GHANA