The State of Eritrea

Department of Environment of the

Ministry of Land, Water and Environment

National Implementation Plan
For the Stockholm Convention on Persistent Organic Pollutants

ASMARA, Eritrea

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This document has to be considered as a technical document. The views expressed in this document and the maps and graphs presented don't necessarily reflect the position of the Government of Eritrea or United Nations Industrial Development Organization (UNIDO).

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Background

The National Implementation Plan (NIP) was developed based on Article 7 of the Stockholm Convention (SC), which was signed on May 23, 2001 and came into force on May 17, 2004. According to the provisions of the Stockholm Convention, each Party shall develop and endeavour to implement a plan for the execution of its obligations under the Convention.

This NIP document has been prepared by the Government of Eritrea and UNIDO within the framework of the UNIDO/GEF Project "Enabling Activities to Facilitate Early Action on the Implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Eritrea", GF/ERI/07/001

National project-executing organization

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This report was elaborated based on the guidance and training provided by Dr. Szabolzs Fejes.

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On behalf of the National Coordinating Committee,

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Foreword

The Department of Environment (DoE) of the Ministry of Land, Water and Environment (MoLWE) is working in collaboration with stakeholders, to put in place a national programme of chemical safety. To ensure chemical safety as an ultimate goal, the Department is set to implement the approach of sound management of chemicals throughout their life cycle.

The national programme of chemical safety aims to eliminate or reduce the adverse effects of chemicals upon human health and the environment to the lowest level possible. Chemical safety measures ensure avoidance of toxicity and eco-toxicity and thus promote national development, including social and economic development.

The programme gives due prominence to coordination and cooperation with sectoral ministries such as the Ministry of Health (MoH) and the Ministry of Agriculture (MoA) in the sound management of chemicals including pesticides. Similarly, appropriate attention is given to the multiplier or synergistic effect of the coordinated implementation of Multilateral Environmental Agreements (MEA) related to chemicals, including the Rotterdam and Basel Conventions.

The NIP for the implementation of the SC is designed to eliminate POPs from Eritrea. They persist in the environment without degradation, accumulate in fatty tissues and bio-concentrate/ bio-magnify through the food web. Moreover, they are volatile and cause harm in destinations far from their source of origin. These properties – persistence, bioaccumulation and volatility – make the elimination of POPs intractable and the need for global cooperation mandatory.

The NIP for the implementation of the SC was originally supposed to deal with the initial twelve POPs known as the ‘dirty dozen’. However, the POPs newly added to the original twelve will also be investigated and included during the NIP update process. Furthermore, we would like to reassure that we are working to meet our obligations to address Article 7 of the SC and encourage the application of Best Environmental Practices (BEP) and Best Available Technologies (BAT).

We highly appreciate the support and cooperation of the United Nations Industrial Development Organization (UNIDO) and the Global Environmental Facility (GEF).

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Abbreviations

APCS	Air Pollution Control System
ASP	African Stockpiles Programme
BAT	Best Available Techniques
BC	Basel Convention
BEP	Best Environmental Practice
CCI	Crop Life International
COC	Chamber of Commerce
COP	Conference of Parties
DDT	Dichlorodiphenyl Tri-chloroethane
DIDA	Danish International Development Agency
DoC	Department of Customs
DoE	Department of Environment
EA	Enabling Activities
EEC	Eritrean Electric Cooperation
EMP	Environmental Management Plan
EMTU	Environmental Management Toolkit
EPLF	Eritrean People's Liberation Forces
ESI	Eritrean Standard Institute
FAO	Food and Agricultural Organization
FIFO	"First-in-First-Out"
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GPS	Global Positioning System
HCB	Hexachlorobenzene
ICC	Intermediate Collection Centres
IPM	Integrated Pest Management
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoH	Ministry of Health
MoJ	Ministry of Justice
MoLWE	Ministry of Land, Water and Environment
MoLHW	Ministry of Labour and Human Welfare
MoEM	Ministry of Energy and Mines
MoTC	Ministry of Transport and Communication
MoTI	Ministry of Trade and Industry
NCC	National Coordination Committee
NEA	National Executing Agency
NEMP-E	National Environmental Management Plan- Eritrea
NGOs	Non-governmental Organizations
NIP	National Implementation Plan
NPC	National Project Coordinator
PCBs	Polychlorinated Biphenyls
PCDD	Polychlorinated dibenzo p-dioxins
PCDF	Polychlorinated dibenzofurans
PMU	Project Management Unit
POPs	Persistent Organic Pollutants
ODS	Ozone Depleting Substances
ONAN	"oil-natural, air-natural"
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
uPOPs	Unintentionally produced POPs

PIC	Prior Informed Consent
RC	Rotterdam Convention
SC	Stockholm Convention

Executive Summary

1. Objectives of NIP Development and Stockholm Convention

The NIP is prepared to meet Eritrea's obligations under the SC on POPs. Article 7 of the SC requires Member States to develop a NIP to meet the obligations of the SC and to communicate the NIP to the Conference of Parties (COP) within two years of the Convention's coming into force. The aim of the NIP is to enable Eritrea to fulfil its obligations under the Convention and to mitigate potential health risks of human and environmental exposure to POPs at both the national and international level. With the overall goal of formulating a NIP for Eritrea in accordance with SC requirements, the MoLWE with support from the UNIDO and financial assistance from the GEF implemented the following project 'Enabling activity to facilitate early action on the implementation of the SC on POPs in Eritrea'.

The overall goal and specific objectives of the SC include the protection of human health and environment from the harmful effects of POPs in Eritrea as well as at the global level, by reducing and ultimately eliminating the use and release of POPs in accordance with the requirements of the SC and national sustainable development objectives and strategies. Specific SC implementation targets are given below:

- Develop national legislation to regulate, control, reduce and eventually eliminate the import, use and production of POPs in the country.
- Establish appropriate institutional mechanisms to regulate the impact of POPs on human health and the environment and strengthen enforcement capacity of such institutions.
- Strengthen national capacity and infrastructure to enable the country to adequately address the requirements of the Convention and the implementation of the NIP.
- Identify and promote the application of Best Available Techniques (BATs) and Best Environmental Practices (BEPs) to enable the reduction from unintentionally produced sources.
- Promote the establishment of research and development centres in order to search for alternatives to the use of POPs and to address their effects on human health and the environment.
- Create public awareness on the requirements of the SC and ensure the participation of the public in addressing the adverse impacts of POPs.
- Establish an appropriate mechanism for adequate data collection, exchange and dissemination and information management system for POPs.

2. Eritrea's Commitment to Implementing the NIP

The Government and people of Eritrea formulated an Environmental Management Plan (EMP) in 1995, as a blueprint for sustainable development and the protection of environmental resources. Among the major issues stated in the EMP are proper chemical and waste management which directly impact environment sustainability and development. The EMP clearly states that Eritrea's priorities are the preparation of legislations, manuals and the increase of its capacity in chemical management. To that effect, the MoA and the MoLWE have developed the following documents concerning management of chemicals including pesticides.

- Primary draft legislation on pesticide management in 1998 (MoA).
- Guidelines for the import, handling, use, storage and disposal of pesticides (developed in 2004 and distributed to all stakeholders by the MoA).
- Basic criteria for a pest control operator's license (developed and distributed by MoA).
- List of pesticides permitted to be imported into Eritrea (revised and updated by MoA).
- The draft Environmental Law issued in 2001 by the MoLWE contains several provisions relevant to chemical management and hazardous wastes. There are also several legal instruments in place that address various aspects of chemical management, including the management of POPs.

Eritrea ratified the major international chemical conventions on March 15, 2005, in recognition of the serious adverse human health and environmental impacts of POPs both at the national and global level, and the need for concerted action to address such impacts. These are the SC on POPs, the Basel Convention (BC) on the Trans-boundary Movement of Hazardous Wastes and their Disposal and the Rotterdam Convention (RC) on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

Eritrea has taken several steps towards meeting its commitments under the SC and for the preparation of the NIP. For instance, it has:

- Established the POPs/NIP project office and a national steering committee.
- Launched an inception workshop on POPs.
- Conducted a training workshop on inventory taking of POPs.
- Carried out a preliminary inventory and assessment of POPs and created a national infrastructure for POPs management.

3. Status of POPs in Eritrea: A Summary

Eritrea became a party to the SC in March 2005 and a project proposal to develop a NIP was prepared with the technical assistance of UNIDO and financial assistance of the GEF in 2005. A Memorandum of Agreement was signed between MoLWE and the United Nations Development Programme (UNDP) on behalf of UNIDO on October 2009 to officially launch 'The Enabling Activity (EA) for developing a NIP under the SC in Eritrea". Project implementation formally commenced on March 2010 after the first tranche of funds had been received from UNIDO.

The first step was the establishment of a national coordinating committee or NCC and a SC administrative unit within the MoLWE. An agreement between the DoE and MoLWE concluded that the latter would handle all personnel matters, as well as project procurement and finances.

The inception workshop and training on inventory and assessment of national infrastructure and capacity was convened from 20-24 September, 2010. The inception workshop report was submitted to the Procurement Services Unit, Operational Support Services Branch of UNIDO in October, 2010. Polychlorinated biphenyl (PCB) test kits were obtained, and an international consultant assisted in training on conducting POPs inventories and testing PCB samples. Thereafter, a POPs (including pesticides, hexachlorobenzene [HCB], and dioxins/furans) inventory was taken commencing in 2010 and concluding in 2011. The inventory and assessment report was sent to UNIDO during the second half of 2011. Following this, the priority-setting workshop and action plan development training was conducted in June 2011. The final endorsement workshop on the NIP for the SC was held on the 15th and 16th of December, 2011 in Asmara.

4. National Priorities and key POPs issues addressed by Action Plans

Based on the criteria agreed upon, the following national POPs priorities for Eritrea have been identified during the national priority setting workshop:

Table 1 Priority areas and objectives

Rank	Priority areas	Objectives
1	Institutional and regulatory strengthening	• Professionally led Import/ Export mechanisms of chemicals including POPs in place, • Control mechanism for discouraging illegal import/ export of chemicals, including POPs • Laboratories capacity for POPs analysis are in place • Trainings are conducted on POPs inventory. • Risk management of POPs is developed • Capacity Building (training, laboratory facility, offices, office equipments, etc) is provided
2	Public awareness, information and education at all levels	• Public is aware of the health effects of POPs • Public is actively and responsively participating in protecting the environment from POPs • Information exchange is strengthened • Healthier environment achieved
3	Integrated approach of all concerned institutions and stakeholders on POPs issues	• Synergy on cross-cutting issues among governmental organizations is in place • Effective and efficient information sharing system concerning POPs and chemicals
4	Environmentally sound management and disposal of PCBs and PCB-containing equipment	• Updated inventory database • Environmentally sound storage of PCB-containing equipment • Gradual phase-out and disposal of PCBs • Contaminated sites identified and managed in an environmentally sound manner
5	Reduction of unintentional POPs releases with a primary focus on open burning activities	• Improved solid waste management policy • Open burning activities discouraged • Public awareness on unintentionally produced POPs (POPs)
6	Identification and removal of stockpiles of Annex A Part I chemicals, including from contaminated locations	• POPs pesticide stocks identified, quantified and disposed of • Contaminated locations contained, reclaimed, or cleaned up
7	Reduced POPs impacts on human health and environment	• Health and environmental impact assessment and analysis carried out • High level ccupational safety in place at workplaces where POPs are present
8	Technical and financial assistance	• Bilateral and multilateral financial resources accessed • Technical assistance for POPs management received

9	Effective monitoring, research and development concerning POPs	• Research programmes for POPs management • Monitoring of POPs impacts on Environment is performed

N.B. The MoH has introduces a substitute for DDT. However, since it is a trial phase, the provision for exempt use should be in place until officially communicated by the focal point to the contrary.

1. Introduction

National Implementation Plan, Eritrea: Purpose and Structure

The NIP is an outcome of the project titled 'Enabling activities to facilitate early action on the implementation of the SC on POPs in Eritrea'. The GEF financed the Project and the UNIDO was the Implementing Agency providing technical guidance and facilitating administrative matters between GEF and the Government of Eritrea.

The NIP document elaborates upon the current situation on POPs and states the country's commitments and the actions that it intends to undertake with respect to the management and control of POPs. In this regard the NIP aims to achieve the following objectives.

1) To demonstrate the commitment of the Government of Eritrea to SC objectives and to achieve compliance with the obligations assumed as a Party to it.
2) To provide a national policy instrument and framework within which POPs issues are to be addressed as a part of national policies on chemicals management, environmental protection, public health and sustainable development.
3) To present a baseline and associated analysis supporting the development and implementation of effective Action Plans and Strategies to achieve reduction and elimination of POPs with associated improvement of environmental quality and human health.
4) To provide an operational and institutional framework for eligibility for financial assistance that might be provided under the SC's permanent financial mechanism for actions on POPs.
5) To provide a basis for monitoring the country's progress in addressing POPs issues, and specifically the effectiveness of the actions it had committed to in reducing or eliminating POPs use and release into the environment.
6) To facilitate public awareness, education and participation with respect to POPs issues and overall improvement in environmental and public health protection.
7) To facilitate ongoing efforts in dealing with broader environmental issues such as the control of pollution, overall pollutant releases, and hazardous wastes, as well as the development and strengthening of national sustainable development strategies.
8) To facilitate the country's overall efforts in coordinating national approaches to other chemicals-related regional and international agreements and international processes on chemicals management, specifically, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International

Trade; the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal; and Strategic Approach for International Chemicals Management.

The Stockholm Convention on POPs

Eritrea ratified the SC on POPs on March 01, 2005. The overall goal of the SC is the protection of human health and the environment from the adverse effects created by POPs. The approach is based on the precautionary approach set forth in the Rio Declaration (which is a set of non-binding principles detailed under the 1992 Rio Declaration on Environment and Development).

The SC establishes measures to reduce or eliminate releases of 22 substances and groups of substances that have been used as pesticides or industrial chemicals or that are unintentional by-products of industrial processes. These substances are listed in Annexes A, B and C of the Convention. The Convention contains the following.

- Obligations relating to the import, export, production, use, release and waste management of POPs.
- Obligations on Parties to use of Best Available Techniques (BAT) and Best Environmental Practices (BEP) to reduce and, if possible eliminate releases of unintentionally produced POPs during combustion and certain industrial processes.
- An obligation for Parties to take measures to regulate, with the aim of preventing, the production and use of new POPs.
- A mechanism for listing more substances in the Convention.

According to Article 7, paragraph 1 (a) and (b) of the Convention, each Party must develop and endeavour to implement a plan for the implementation of its obligations under the Convention, each Party will also transmit its implementation plan to the COP within two years of the date on which this Convention enters into force for it. The NIP shall also be reviewed and updated in a manner specified by a decision of the COP. Among others, the addition of chemicals to the Annex is a factor that leads to the need to review and update the original NIP for a Party. At the fourth and fifth COP meetings in May 2009 and April 2011 respectively, the SC was amended to include ten additional POPs in the Annex. Thus, most Parties of the Convention will have to review, update and resubmit their NIPs within two years of this amendment coming into force.

General Information about POPs

POPs are chemical organic compounds that have severe toxic effects on humans and wildlife. They are characterized by a persistent presence in the environment, low biodegradability, bioaccumulation in human and animal tissues, bio-magnification in the food chain and the ability

to spread to areas far removed from their sources of origin. The POPs have a resistance to degradation through chemical, biological, and photolytic processes and thus have long half-lives.

The chemical characteristics of POPs are low water solubility, high lipid solubility, high molecular masses and semi-volatility. High lipid solubility is a source of bio-concentration of POPs substances in living organisms and thus in food chains. Because POPs are semi-volatile, they can exist as vapour or be absorbed by atmospheric particles called aerosols. This property allows a high degree of long-range mobility in the atmosphere.

The SC has identified 22 chemicals to be eliminated or reduced which are listed according to some criteria in three different Annexes: Annex A (subject for elimination), Annex B (subject for restriction), and Annex C (by-product). Some chemicals are organochlorine pesticides (aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, hexachlorobenzene (HCB), mirex, toxaphene, α- HCH, β- HCH, γ- HCH (lindane), chlordecone, DDT, and endosulfan), others are used in industrial applications (hexabromobiphenyl, c-Tetra/ PentaBDE, c-Tetra/ HeptaBDE, PFOS/ its salt/ PFOSF (listed in Annex B), pentachlorobenzene (also listed in Annexes A and C), hexachlorobenzene (also listed in Annexes A and C), polychlorinated biphenyls (PCBs, also listed in Annex C), and by-products which are unintentionally released during thermal processes burning organic matter and chlorine (dioxins, furans, PCBs, HCB and pentachlorobenzene).

Outline of NIP, Eritrea

In accordance with the guidance for developing a NIP for the SC, the NIP for Eritrea is divided into three chapters. Where the preceding sections consisted of the Executive Summary and the Introduction to NIP, chapter two consists of the country baseline and outlines the country profile and its policy, legal and administrative framework. Chapter three assesses the inventory and status of POPs in the country. It also lays out the strategy and action plan elements of the NIP including the policy statement, implementation strategy, identification of priorities for POPs management, involving stakeholders and governmental counterparts, as well as monitoring, evaluation, reporting and updating NIP activities.

2. Country Baseline

2.1. Country Profile

Like all other African countries the formation of Eritrea as a country was the result of European colonialism, which took place at the turn of the 19th century, but its people have a long history that goes back to ancient times. Between the 7th and 13th centuries, new independent political entities of different types emerged in Eritrea. Starting from the 16th century, however, Eritrea had fallen under the control or influence of different foreign powers, including the Turks, Egyptians and in modern history by Italy, Britain and Ethiopia. In 1890, Italy declared Eritrea as its colony. After the defeat of Italians during the Second World War, Eritrea was placed under the British military administration (1941-1952). Then Eritrea was associated with Ethiopia in a federation decided by the UN General assembly in Article 390A(V) in 1950, then 1961 Ethiopia annexed Eritrea, Which led to a Thirty years war of independence culminated in1991 with the liberation of the country.

1.1. Geography and Climate

Eritrea is situated on the horn of Africa and lies north of the equator between latitudes 12º22' N and 18º02' N, and longitudes 36º26' E and 43º13' E. It has an area of about 124,320 square kilometers. To the east, Eritrea is bordered by the Red Sea, extending about 1,347 kilometers. The Republic of Djibouti borders Eritrea in the southeast, Ethiopia in the south, and the Sudan in the north and west (Figure 1). Administratively, Eritrea is divided into six regions (Zobas): Anseba, Debub, Debubawi Keih Bahri, Gash Barka, Maekel, and Semenawi Keih Bahri,

In simplistic terms, the country is divided into three physiographic regions, namely, the central highlands, the mid lands and the lowlands. There are two rainfall regimes, summer and winter, whose pattern is affected by the physiographic regions. The summer rains, which are mainly concentrated in July and August, cover the whole central highland and the western lowlands. The southwesterly winds are responsible for the summer rains which is the main rainy season. The winter rains occur from November to March and are brought about by the north and northeasterly continental air streams. These rains affect the coastal, eastern and southern escarpments.

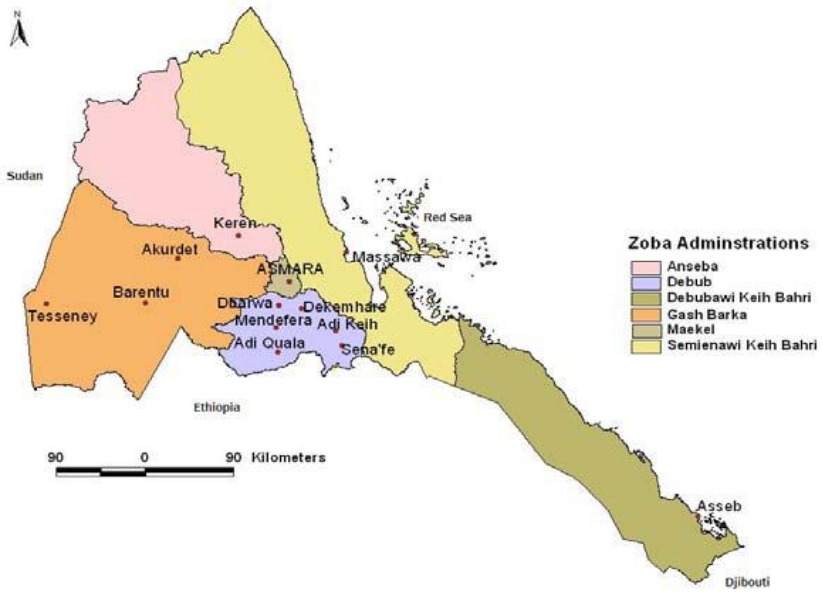


Figure map of Eritrea major towns and its Zoba administrations

2.1.2. Population, Language and Culture

The population of Eritrea stands at 4,906,600 million (Eritrean Statistics Office 2007 estimate) and is composed of nine ethnic groups and languages. English is used as a media of instruction in academic institutions and international relations.

2.1.3. Socio- economic Profile

About 80 percent of the population of Eritrea depends on agriculture and pastoralism for its livelihood. The agricultural sector depends mainly on rain, with less than 10 percent of the arable land currently irrigated. Eritrea has an abundant natural resources including arable land (26 percent of the total area) of which only less than 4 percent is under cultivation (WFP, 2002).

The other natural resources available in the country include marine resources, mineral resources, and a beautiful landscape with sea resorts and historical sites that augur well for the tourist industry. Currently one of the promising assets for the economic development of the country is the mining sector. The sector has attracted about 20 listed companies of which the Bisha mining company has already began production and sales of gold. According to the 2008 estimate the per

capita Gross Domestic Product (GDP) of Eritrea was about US$295 (The African Report on Child Wellbeing, 2011).

1. Maekel
2. Debub
3. Gash-Barka
4. Anseba
5. Northern Red Sea (aka Semien-Keih-Bahri)
6. Southern Red Sea (aka Debub-Keih-Bahri)

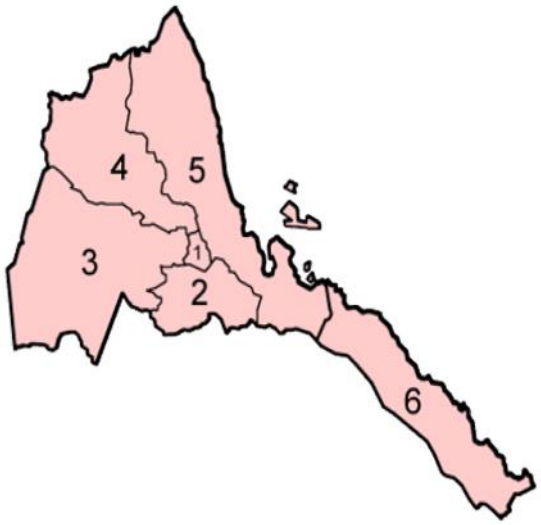


Figure 1 Zobas : the administrative zones of Eritrea

Eritrea is developing country, with a per capita GDP of about US$ 295 per annum. The Purchasing Power Parity or PPP of the GDP stood at US$970 million in 2005. Agriculture, fisheries and forestry contributes 22.6 per cent to the GDP while industry and the services sector contribute 22.6 per cent and 54.8 per cent respectively. In total, 81 per cent of the workforce (as per 1990 estimates) is involved in agriculture, fisheries and forestry.

2.1.4. Infrastructural Profile

The country has wet and dry weather roads. The wet weather roads are from Asmara to Massawa, Mereb, TalataÁsher and to Ser'ha. Dry weather roads are distributed throughout the rest of the country and are unpaved. A paved road from Forro to Assab is being constructed. Renovation of the steam railway between Massawa and Asmara is almost completed, but it is primarily intended to serve tourism. Two national airlines the Eritrean Airlines and Nasair provide air transport to the Middle East and Italy. Debub, and Anseba have electricity (220 volts) 24 hours, while others are being electrified. Mobile phone services are available in most urban and rural locations of the country. Fixed telephone services are available in cities and towns.

2.1.5. Profiles of Economic Sectors

2.1.5.1 Agriculture

Agriculture has been the mainstay of the Eritrean economy and employs up to 80 per cent of the population. Most are crop producers and pastoralists and some run mixed farming operations. Commercial and semi-commercial farmers produce and market vegetable and fruit crops. The types of agriculture practiced include pastoralism, agro-pastoralism and sedentary agriculture. The agricultural community can be categorized into subsistence, commercial, semi-commercial, and parastatal farming where vegetable, fruit crops and ornamental plants are raised. The type of agriculture practiced depends upon the climate and resources of the area. Potential exists to increase the area of land used for both rain-fed and irrigated agriculture.

Commercial farming in Eritrea expanded widely in the highlands and lowlands between 1952 and 1974. During the mid-1970s, Eritrea became a centre of productive and competitive commercial agriculture producing dairy products, vegetables, fruits, fibre and oil crops. However, all this was negatively affected by the intensification and escalation of the war of independence against Ethiopia from 1974 until liberation in 1991. Almost all infrastructure was destroyed as a result of the war and exports ceased in 1974. Since its independence, the Government has been trying to revitalize agriculture to enhance food security, provide raw materials to domestic industries, and, open employment opportunities and foreign trade through export of agricultural produce and products.

Production of vegetables, fruits and ornamental crops has been improving through the introduction of irrigation using both surface and underground water sources (dams, ponds, diversions, and wells). Soil conservation and reforestation coupled with water conservation techniques are being focused on, to reduce the dependence on the variable rains and weather patterns in Eritrea. Various types of field crops such as cereals, legumes, fibre and oil crops are cultivated extensively using modern techniques including heavy machinery, fertilizers, improved seeds, and pesticides. Livestock productivity has improved with the introduction of modern techniques such as improved breeds and modern feeds; and prevention and control of animal diseases and parasites. There is also a move to cultivate high value cash and strategic crops with the aim of developing an efficient, competitive, and sustainable agricultural economy.

Pastoralists (5 per cent of the population) are found mostly in the extreme south-east (near Djibouti) and around the northern border with Sudan. Agro-pastoralists (25 per cent) are found in both the eastern and western lowlands. Agricultural households (70 per cent) tend to be in the western lowlands and the highlands. Intensive farming is carried out in the highlands where population densities are high and the average farm size is small. Large slopes in the highlands have led to significant erosion, poor soil moisture retention and a reduction in yield. The major local crops are barley, wheat, field beans and chickpeas. Sorghum tends to be grown at lower altitudes while African finger millet is grown countrywide. The main oil-seed crops are sesame,

linseed, rape, groundnuts and a local crop called nihug. Small-scale irrigation schemes based on micro-dams allow the production of fruit and vegetables that are then sold at local markets. Broad scale farming tends to be carried out in the south-western lowlands where there are fertile soils, gentle slopes and less variable rainfall.

The most productive form of agriculture in the eastern lowlands is associated with spate irrigation which diverts part of the seasonal floods to irrigate crops of mostly sorghum, millet, some maize and, if the season is good, cash crop of melons. Livestock is concentrated in the lowlands (60 per cent) with around a quarter of the cattle being draught oxen while dairy farms are mostly found around Asmara and, to a lesser extent, around other urban and suburban areas.

2.2. Institutional, Policy, and Regulatory Framework

2.2.1. National Obligations to Environment, Chemicals Management and Agriculture

The Government of Eritrea has been dealing with the conservation and protection of the environment since its independence. In its macro-policy of November 1994, the Government iterated that one of the principal national development objectives is “an upgraded and safe-guarded environment that is free from pollution”. Article 8 of the National Constitution also stresses the need for “Safeguarding the environment” and “Suitable and balanced management of natural resources”. In implementing these policy frameworks, the Government has promulgated some environmental legislative frameworks, including “Legal Notice No. 114/2006: Regulations for Importation, Handling Use, Storage and Disposal of Pesticides”. In 1995, a National Environmental Management Plan-Eritrea (NEMP-E) was adopted for Eritrea. In 1999, National Environmental Assessment Procedures and Guidelines were put in place by the Government. In 2005, an Environmental Assessment Procedure and Guideline for Agricultural Projects were developed but are yet to be officially disclosed to the general public. In 2006, the Government issued Legal Notice 114/2006, Regulations for Importation, Handling, Use, Storage and Handling of Pesticides.

Recognizing the issues, the Government of Eritrea has produced a significant number of legislations, guidelines and procedures with regard to the environment. One such an example is the ban on importation of thin plastic bags by a Legal Notice, which is being strongly enforced with penalties being given in the event of a violation. More pragmatic approaches have also been taken in order to avoid extensive use of pesticides. An example is the fight against the desert locust, where biological control trials using various strains of fungus pathogens have been

conducted at both laboratory and field levels from 1995 through 1997, in collaboration with Montana State University. Additionally, a prevention strategy, i.e. early intervention against desert locust, has been in place since the 1992/93 outbreak with the aim to minimize usage of pesticides that are deemed to contribute to environmental pollution and contamination, with an emphasis on lessening the impact on marine organisms. In 2006, Eritrea announced it would become the first country in the world to turn its entire coast into an environmentally protected zone. The 1,347 km coastline, along with another 1,946 km of coast around its more than 350 islands, will come under governmental protection.

The MoA has taken further proactive approaches by undertaking several pesticide inventories across the country since 1997. The Government has sought the assistance of external agencies for the management and safe disposal of pesticide stockpiles. In this regard, Eritrea has recognized the importance of joining ongoing initiatives for the management of obsolete pesticide stocks and has actively participated in the Africa Stockpiles Programme (ASP) as an observer, and participated in a number of workshops. Most recently, in October 2007, Eritrea presented the status of its obsolete pesticide management project at the ASP forum in Rabat, Morocco.

2.2.2. National Legal Framework

Table 2 outlines the existing national legal framework listing the legal instruments that are in draft form or have been promulgated.

Table 2. National legal framework related to pesticides and environmental protection

Sector	Existing National Regulatory Regime	Year`	Present Status
Environment	Environment low	2012	Draft form
	NEMP-E	1997	Adopted
	Eritrean National Code of Conduct for Environmental Security	1995	Adopted
	National Environmental Assessment Procedures & Guidelines	1999	Adopted

Sector	Existing National Regulatory Regime	Year`	Present Status
	Proclamation on Biological Diversity	1998	Draft form---
	Regulations for the Issuance of Permit for the Importation or exportation of Ozone Depleting Substances (ODS) and ODS Based Equipment or Products	2010	Adopted
Agriculture	Agricultural Sector Policy And Strategy Framework	2002	Adopted
	Plant Quarantine Proclamation, N0.156/2006	2006	Promulgated
	Legal Notice N0 114/2006, Regulation for Importation, Handling, Use, Storage and Handling and Disposal of Pesticides	2006	Promulgated
Health	Policy and Guidelines For Malaria Control in Eritrea	2003	Adopted
	Environmental Health Policy and Guidelines	1998	Adopted
Trade and Industry	Eritrean Standard Institute Proclamation	1995	Promulgated
	Regulation to Declare Eritrean Standards Institute	1997/2000/ 2004	Promulgated
Transport and communications	The Eritrean Port Regulation	2005	Adopted
	Transportation of Goods Regulation	2002	Adopted
	Land Transport Proclamation	2000	Adopted
Science and Technology	The Eritrean Science and Technology Development Agency Establishment Proclamation	1993	Adopted
Finance	Customs Proclamation	2000	Adopted
	Customs Regulation, Legal Notice No. 52	2001	Adopted
	Reporting of Imported Goods, Legal Notice No 54	2002	Adopted
	Regulations of the Storage of Goods in Customs Post, Legal notice No 77	2003	Adopted

Sector	Existing National Regulatory Regime	Year`	Present Status
	Free Zones Proclamation	2001	Adopted

2.2.2.1. Roles and responsibilities of relevant governmental institutions

Certain line ministries and agencies have responsibilities in one way or another, to manage chemicals or address their impacts on human health and the environment in Eritrea. The main agencies with respect to the POPs issue are outlined hereunder.

Ministry of Land, Water and Environment: Deals with direct and indirect effects of chemicals released into the environment.

The MoLWE is the focal point of chemical-related Conventions, one of which is the Stockholm Convention on POPs. As the lead agency for overall project management and coordination and the National Executing Agency (NEA)for Eritrea's SC commitments, the DoE coordinates the different task teams and the project. It also appoints the Project Coordination Unit (PCU) and the National Project Coordinator (NPC) and recruits supporting staff and other national consultants as required.

Ministry of Agriculture (MoA): Deals with use of agricultural chemicals as an option for securing food supplies while ensuring a high level of safety.

To this end, the MoA controls the use of POPs as pesticides; provides PCU with relevant information on research findings, applications, and environmental impacts and conducts research on alternative options like Integrated Pest Management (IPM). It also assists the PCU and NEA on the risk management of pesticides and allows the import of pesticides that are not persistent toxic substances.

Ministry of Health (MoH): Deals with short- and long-term human health impact of chemical usage, and with vector control management.

The MoH achieves the above objectives by creating user awareness on safety and other procedures needed for the use of DDT and the possible alternatives to DDT-use; helping in the assessment of environmental and health impacts of POPs; reporting intentional and unintentional pesticide poisoning; ensuring the use of DDT is restricted to indoor spraying for controlling

mosquitoes; motivating hospitals and other health services to incinerate their wastes in an environmentally friendly manner.

Ministry of Finance/ Department of Customs (DoC): Deals with legal regulations on import and export of chemicals in Eritrea and beyond its borders.

The DOC records the import and export of pesticides, tracks illegal trade of POPs, and controls POP imports through the use of legal permits.

Ministry of Transport and Communication (MoTC): Deals with the safe transport of chemicals by air, water and land.

The MoTC prepares, submits and upon approval, implements standards relating to smoke, gas, vapour and the like emitted from the exhaust pipes of vehicles with a view to preventing pollution.

Ministry of Trade and Industry (MoTI): (I) The Department of Trade deals with the import and export of chemicals and can issue relevant trade permits.

To this end it has developed a licensing system for importers of POPs and equipment that uses POPs.

(II) The Department of Industry: Deals with the production, use, safety and emission management of chemicals.

To this end, it introduces the application of clean technology (BATs/BEPs); reports on emissions and effluents generated; keeps records on industries that use, import and export POPs.

III

Ministry of Labour and Human Welfare (MoLHW): deals with the occupational implications of handling of chemicals in the work place including agricultural workers.

The MoLHW gathers data on the health and safety of workers and investors; acts as a bridge between the DoE and different associations (such as those of importers, retail sellers, farmers and end users if there are any).

Ministry of Foreign Affairs (MFA)

The MFA is the political focal point for all environment-related conventions; offers legal and political support; helps in disseminating information both ways (locally as well as – internationally).

Ministry of Energy and Mines (MoEM)/ Eritrean Electric Corporation (EEC): deals with the production, supply and distribution of Electrical Energy to all sectors and takes care of the maintenance of these Electrical machines and equipment.

The MoEM in general and the EEC in particular are responsible in supplying all electrical equipment their spare parts free from PCB or PCB based. For those which are already in the country, they need to be managed properly till the budget is available for safe disposal.

Ministry of Justice (MoJ)

The MoJ helps in policies and controlling mechanisms such as, legislations, directives, guidelines and standards.

2.2.2.2. Relevant international commitments

Understanding the overall importance of issues associated with hazardous chemicals such as pesticides, the Government of Eritrea has reacted in a number of ways to address the problems. In doing so, Eritrea has signed the following three international conventions that relate to hazardous chemicals management.

The Rotterdam Convention, Prior Informed Consent (PIC)

Eritrea signed the Convention in March 2005. The objective of the Convention is to promote shared responsibility and cooperative efforts among Parties in the international trade of certain banned or severely restricted hazardous chemicals and severely hazardous pesticides formulations, in order to protect human health and the environment from potential harm.

The Basel Convention on Transboundary Movement of Hazardous Waste and their Disposal

Eritrea signed the Convention in March 2005. Objectives of the Convention include ensuring environmentally safe transfer, disposal of hazardous wastes, and limiting “toxic trade” in hazardous wastes.

The Stockholm Convention on Persistent Organic Pollutant

Eritrea signed the Convention in March 2005. The objective of this Convention is to protect human health and the environment from POPs. The Convention originally covered 12 chemicals. However in May 2009, nine additional chemicals were listed as POPs and in May 2010, endosulfan was listed as the twenty-second POP chemical.

Advantages for being a signatory to these Conventions include the following.

i. Allow Eritrea to dispose of hazardous waste especially obsolete pesticides, in countries that have suitable technologies to treat such wastes.

ii. Prevent Eritrea from becoming a dumping ground for hazardous chemicals produced elsewhere in other countries.
iii. Prevent accumulation of hazardous waste in Eritrea.
iv. Contribute to the development of chemical management-capacity in Eritrea
v. Enable Eritrea to contribute to the global efforts being going on to decrease chemical pollution

Table 3 outlines the various international environmental agreements to which the Government of Eritrea has become a party.

Table 3. International Conventions and Agreements in which Eritrea is a party

Convention	Description	Date of Accession	Present Status
CCD	Convention to Combat Desertification	1994	Acceded
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	22 January 1995	Acceded
UNFCCC	United Nations Framework Convention on Climate Change	24 April 1995	Acceded
CBD	Convention on Biological Diversity	21 March 1996	Acceded
WHC	World Heritage Convention	2001	Acceded
IPPC	International Plant Protection Convention	6 April 2001	Acceded
Rotterdam	Convention on Prior Informed Consent (PIC)	1 March 2005	Acceded
Stockholm	Convention on Persistent Organic Pollutants (POPs)	1 March 2005	Acceded
Basel	Convention on Trans-boundary Movement of Hazardous Wastes and their Disposal	1 March 2005	Acceded
Vienna	Convention for the Protection of the Ozone Layer	2 March 2005	Acceded
Montreal	Protocol on Substance that Deplete Ozone Layer (ODSs)	2 March 2005	Acceded
CPB	Cartagena Protocol on Bio-safety to the Convention of Biodiversity	10 March 2005	Acceded
Kyoto	Protocol on Climate Change	27 July 2005	Acceded
CMS	Convention on Migratory Species	November 2005	Acceded

Convention	Description	Date of Accession	Present Status
FAO Code of Conduct	Agreement for the Distribution and Use of Pesticide		Voluntary

2.2.2.3. Existing legislation and regulations in Eritrea addressing POPs

There is no legislation in Eritrea devoted to the management of POPs. However, there is one legislation, which is applicable in one way or another. This Legal Notice was issued to determine the import, handling, use, storage and disposal of pesticides. The National List of Pesticides is also attached to the Legal Notice as an annex, containing a list of 81 insecticides, fungicides, herbicides, rodenticides, nematocides, acaricides, adjuvant and hormones; further naming three chemicals under restricted use. Among the three restricted, two are dealing with POPs chemicals which are DDT and Endosulfan, being restricted for controlling malaria and cotton use respectively. However, the Ministry of Health is making trials of other chemicals and non chemical alternatives to DDT. The Legal Notice seeks to address issues that could arise pre- and post-import. It restricts imports to those mentioned in the National List of Pesticides; importation of pesticides outside this list is proscribed, except for scientific purposes.

2.2.2.4. Gap analysis and limitations of institutional and regulatory framework

- There is a lack of provisions on safety of handlers and applicators of POPs or any chemicals in Eritrea.
- There is a lack of legislation that directly and comprehensively regulates industrial chemicals including Polychlorinated Biphenyls (PCBs)
- There is a lack of enabling legislations and standards to regulate releases of unintentionally produced POPs from different source categories of the SC.
- There is a lack of a proper regulatory framework on information gathering and exchange on chemicals generally, particularly POPs.
- There is a lack of a regulatory framework on public awareness and knowledge on POPs.

2.2.2.5. Lessons learned and conclusions

The legal review and technical infrastructure task team developed questionnaires leading to the formulation of the following conclusions.

- Eritrea has no laboratory equipped to analyze organochlorine pesticides.

- There is no equipment to monitor Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF) in Eritrea.
- So far, there is no national research being conducted on POPs, nor is any research institution involved in any international research project on POPs.
- There is no accredited laboratory in Eritrea which can detect the presence of POPs in food, air and water.
- Currently there are no occupational physicians, nurses or clinical toxicologists with knowledge on human health impacts related to POPs chemicals in Eritrea.

2.3. Assessment of the POP Issue in Eritrea

2.3.1. POPs Pesticide (Annex, Part I, Chemicals)

2.3.1.1. Overview of national pesticides inventories

Using local resources, a national inventory of pesticides was conducted in October 2001 by the MoA. The inventory covered all six *zobas*. A report was produced and the results of that inventory gave an indication of the sites and stores that held obsolete pesticides. The inventory did not follow any specific standard but was conducted to generate a baseline. Data was obtained for each *zoba* but a final tally was not carried out. From the inventory data produced in 2001, a project proposal for disposal of obsolete pesticides was prepared and a request made to FAO for technical and financial support. The project proposal was accepted and an inventory of obsolete pesticides according to FAO guidelines was undertaken in five of the six *zobas*, namely Maekel, Debub, Northern Red Sea, Anseba, and Gash-Barka in 2003. The Southern Red Sea *zoba* was not included in the 2003 inventory because its pesticide stocks were considered insignificant and time was too limited to undertake it.

The 2003 inventory was conducted by a small team of personnel from the MoA and MoLWE, with technical assistance from FAO. The inventory data found over 1,000 tonnes of obsolete pesticides and contaminated materials in the five *zobas*. In addition, the types of obsolete pesticides, quantity of obsolete pesticides and a number of stores with high risk were identified. Training was conducted by FAO for the staff of the MoA and MoLWE, as well as for private stakeholders on inventory taking for obsolete pesticides. An environmental risk assessment was also conducted for all the stores inventoried. Based on the 2003 inventory report, another project proposal was prepared and submitted to the FAO for support. The request was accepted in 2006, however, because of the three-year lapse between the submission and approval of the new project, and taking into account the movements of pesticides that occurred during that period, the inventory needed to be repeated. The new project focused on updating the 2003 inventory by conducting a comprehensive inventory of all six *zobas* and including a Country Environmental

and Social Assessment in it. The new inventory also included veterinary products, stores of the MoH and a survey of contaminated soils, empty containers, contaminated materials and buildings. The project was launched in September 2006 and the inventory was completed in 2007.

2.3.1.2. Strengthening national capacity on human resources

Efforts to build capacity have been going on for a number of years. Recognizing the impact of pesticide use in Eritrea, two senior plant protection staff attended the 1996 International IPM Symposium in the United States of America being sponsored by Virginia Tech University and funded by USAID. Plant protection staff, extension development agents and farmers took national IPM trainings in 1996 funded through USAID and conducted by experts from Virginia Tech.

In 2001, there was a national IPM workshop in Asmara organized by the MoA and the International Centre of Insect Physiology and Ecology or ICIPE (Kenya), with funding from the Danish International Development Agency (DANIDA). In addition, in the same year, four staff members of the plant protection services of the MoA were trained in integrated pest management (IPM) at ICIPE in Kenya. A more direct intervention on pesticides was launched in 2001. A national inventory of pesticide stocks was conducted by MoA staff without any technical support from external agencies. Consequently, no capacity building exercises were undertaken during that time. That inventory relied upon the local knowledge of the technical staff involved in the inventory.

In 2003, another inventory was undertaken with the collaboration of the MoA, MoLWE and FAO Technical Personnel. During the process, a very detailed training programme was conducted for the staff of the ministries involved. Among other topics, it mainly covered the process involved in undertaking a pesticide inventory which included safety, use of protective equipment, use of forms, and classification of pesticides. Twenty-four staff members participated.

The NIP development project (UNIDO/GFERII07001) initiated an inventory in 2006 which differs significantly from the 2003 inventory because it focuses more on the prevention of pesticide accumulation. Consequently, during 2006 and 2007, a series of training programmes were conducted in a variety of areas (Table 4).

Table 4. Trainings held in 2006-2007 under project FAO/GCP/ERI/JPN/011

Topic	Number of people trained
Inventory planning training/workshop	31
Inventory implementation training	28
Project management (project planning and logical framework)	4
Project management and Microsoft project	10
Obsolete pesticide management system and data analysis	5
Store management training	15
CESA	10
Pesticide empty container management scheme	19
Pest and pesticide management national workshop	56
Total	**178**

Workshop decides methodology of inventory

An inventory planning workshop was held in November 2006, where participants decided to divide pesticide holders into two categories with respect to which methodology should be used to conduct an inventory. The two methodologies agreed upon were physical inspection and questionnaire survey.

Physical Inspection

Physical inspection is the best method for conducting the inventory with stakeholders such as Government, importers and distributors, and commercial agriculture, for the following reasons:

1. they have known, specific addresses;
2. they are few in number;
3. they are likely to have quantities of pesticides that will be obsolete and will require inventorying for CESA and later, safeguarding activities;
4. from past experience, they are relatively cooperative, having provided the requested information;
5. they are accessible (for transportation); and
6. most of them are expected to have an organized stock documentation system.

The bulk of the pesticides are found in the Government sectors. Therefore, the necessary information can be obtained, including the historical status of obsolete pesticides since they share the same organizational structure. Retailers, shops and markets may have stocks that require inventorying and will require site inspections.

Questionnaire survey

In the case of the community or general public, the project adopted a different approach, using a statistical survey methodology and using organizations trusted by the public to gather the information. This is because:

1. the large number of households and farmers cannot all be contacted;
2. the quantity of their holdings is likely to be small; and
3. They are likely to have issues other than obsolete stocks, e.g. empty containers and contaminated homes from anti-malarial treatment.

To engage with this sector of society, it is important to use a non-threatening approach so that they cooperate willingly and explain all their pesticide issues. The survey was undertaken by a national consultant along with the Eritrean Social Marketing Group, which is experienced in surveys related to HIV/AIDS. The studies were conducted using structured and semi-structured questionnaires. The surveys engaged the staff of the MoA, MoH, MoD, MoLWE, pesticide importers, farmers, parastatal farms and private farms in the *zobas* and sub-*zobas*. Data on pesticide use, procurement of pesticides and storage systems was collected. The study showed that the major users of pesticides tend to be the parastatal farms, vector control authorities and migratory pest control operations (Tables 5 and 6).

Table 5. Pesticides user profile

Farmers	Sample Size	Area (Ha)	Total pesticide used (L/kg/Ha)	Mean	Estimate total spray
Small scale	240	2,541	6,814	2,7	155,000
Private/semi–commercial	17	788	5, 425	6,9	33,000
Parastatal/state owned	13	9,354	66, 376	7,1	62,000
Total	270	12,683	78,615	16,7	250,000

Table 6. Use of pesticides

Users	Pesticide used (litres)
Vector control	33,481
Livestock external parasites	6,090
Migratory pest	80,000
Storage pest control	1,600

The surveys identified that subsistence farmers and the general public did not hold stocks of obsolete pesticides. The poor financial circumstances of these groups forced them to use all the pesticides they had in stock before procuring new ones, regardless of their efficacy or appropriateness for use. There is a general lack of awareness about pesticides and subsistence farmers will use any pesticide (frequently the wrong types) to tackle pest problems. The use of empty pesticide containers for the storage of highly combustible material was identified as an issue. This will be addressed by establishing a container management scheme in Eritrea in conjunction with an awareness- raising campaign.

Scope of the inventory

The original plan of the inventory and environmental assessment was to cover a total of 140 stores at 80 known sites. During the preparation and implementation of the inventory, further research was undertaken to identify any and all additional stores so that they could also be inventoried. In the end, 290 stores were inventoried. An estimated 1,000 tonnes of obsolete pesticides and contaminated materials, more than 200,000 empty pesticide containers, as well as non-functional sprayers, and contaminated soil would be inventoried from different sectors such parastatal farms, importers, retailers and private sectors. These figures were based on the results of the 2003 inventory.

The inventory teams listed all pesticides including those that appeared usable, so that currently usable pesticides that would exceed their shelf-life by the time safeguarding commenced, could be reclassified as obsolete.

Identified activities for conducting the inventory

The key activities identified for conducting the inventory are listed below under three heads: before implementation, during implementation, and after implementation.

Before implementation

i. Reviewing inventory planning document to fill the gaps.
ii. Formulate a national Project Management Unit (PMU) for coordination and implementation of activities.

iii. Identifying names, locations and contact details of all participating sectors.
iv. Communicate with and visit stakeholders where the details of the stores are unknown, such as Grain Board, Customs, and Port Authority.
v. Planning the training activity for the inventory teams (ministries and parastatal personnel) identified to conduct the inventory. This involves training for all field managers and ministry staff at *zoba* level and headquarters from both MoLWE and MoA.
vi. Identifying priority sites from the 2003 inventory which may need emergency safeguarding.
vii. Procurement of all materials (personal protective equipment, capital items) necessary for the inventory.
viii. Investigate the security situations in the *zobas*.
ix. Identify hospitals and clinics, with their locations and telephone numbers, to be used in the event of an accident during the inventory.

During inventory

i. Carry out inventory of the stores in all *zobas* of the country using FAO Obsolete Pesticide Management System or OPMS forms.
ii. Monitor and evaluate the progress of the inventory.
iii. Identify other stores to be inventoried.
iv. Identify additional priority sites which may need emergency safeguarding from current inventory.
v. Compile data from the inventory forms into the FAO OPMS(a web-based database).
vi. Identify stores that may be suitable as intermediate collection centres for safeguarding.
vii. Identify safe routes for transporting pesticides.
viii. Conduct an environmental assessment of each site.

After the inventory

i. Analyse inventory data.
ii. Develop a prioritization strategy for the safeguarding and disposal of stocks in all *zobas*.

2.3.1.3. Status of the pesticides issue in the country

The inventory was undertaken in six *zobas* over a period of six months from April to September. A total of 290 stores in 146 sites were surveyed and six Field Managers trained in conducting the

inventory using OPMS forms. The OPMS system was developed by the FAO for the Africa Stockpiles Programme (ASP) and has been made available to countries worldwide to assist them in compiling accurate inventories and analysing the data with a minimum of effort. The system also helps countries to formulate a safeguarding and disposal strategy. The data collected from the inventory was entered into the OPMS by MoA staff.

The inventory gathered data on pesticides, veterinary pesticides, empty pesticide containers, contaminated materials (e.g. seeds and fertilizers), contaminated equipment (e.g. sprayers) and contaminated soils. The summary of the inventory findings are shown in Table 7.

Table 7. Summary of inventory findings

Pesticides	**Tones**
Obsolete	335.4
Usable	56.0
Requires Testing	163.4
Total	**554.8**
Contaminated sites	21
Area of contaminated soil	1,400 Sq. meters
Contaminated materials	16 tones
Sprayers	5,411 pieces
Empty containers <= 5L	10,845 pieces
Empty Containers>5L and <=25L	540 pieces
Empty containers > 25L	783 pieces
Empty containers >25 and <200 L	83 pieces
Empty containers = 200L	713 pieces

Obsolete pesticides, including veterinary products account for 335.4 tonnes. In addition, 163.4 tonnes of pesticides that have long since exceeded their expiry date, could be still put to use by the MoA which believes that they could still be effective. These include DDT, 2,4-D, triadimefon, and chlorpyrifos. Croplife International (CLI), the association of pesticide manufacturers, has agreed to sample these materials and confirm whether they are usable. The inventory took place during the planting season during which there was both movement and use of pesticides. The inventory team established a mechanism for the MoA in the *zobas* to report stock changes so that the OPMS data could be kept current.

The majority of pesticides stockpiled in Eritrea are organochlorines, organophosphates or carbamates. The bulk of pesticide stocks are located in the Gash-Barka and Maekel zobas. Most pesticides are mainly stored and distributed from *zoba* Maekel..

Table 8 Distribution of stores and pesticide stocks

Zoba	***Number of Stores***	***Pesticides and Veternary Pesticides (tones)***			
		Obsolete	usable	Requires Testing	Total
Northern RS	33	59.1	0.4	3.8	63.3
Southern RS	18	27.0	0.2	2.9	30.1
Anseba	51	27.6	0.7	1.6	29.9
Gash Barka	86	54.0	1.1	115.5	170.6
Maekel	51	134.0	51.9	21.7	207.6
Debub	51	33.7	1.7	17.9	53.3
Total	**290**	**335.4**	**56.0**	**163.4**	**554.8**

Status of inventory of unidentified pesticides

Since most of the pesticide stock are extremely old, many of the containers have lost their labels and therefore the contents are unknown (Table 9). As per FAO's inventory guidelines, batches of unknown pesticides greater than 200 kg will be sampled and analysed to determine the active ingredients.

The 8.8 tonne batch in *zoba* Southern Red Sea is a pile of broken sacks on pallets out in the open at the Port of Assab. No one knows what the materials are, but for security reasons, they will be sampled. If they prove to be pesticides, this site will be classified as critical and will be prioritized for safeguarding.

Table 9 Unknown pesticides

	Unknown Pesticides and Veterinary Pesticides			
Zobas	Number of Batches	Number of batches >200 kg	Quantity (tones)	Quantity of largest batch
Northern RS	20	5	7.4	4.1
Southern RS	3	2	11.4	8.8

Anseba	21	10	9.1	2.2
Gash Barka	39	7	22.3	8.4
Maekel	26	11	18.2	8.0
Debub	51	17	17.6	3.8
Total	**160**	**52**	**86.0**	

Sites contaminated with pesticides

In all, 21 locations with a total surface area of 1,400m^2 were identified during the inventory. More detailed investigations are required to assess the depth and spread of the contamination. Soil sampling equipment will be made available for the inventory teams to undertake these investigations. The three largest sites are those associated with locust control activities where drums of pesticides have somehow opened and spilt their contents during off-loading from vehicles or during loading into aircraft or vehicle-mounted sprayers. The old airport at Massawa, that has an area of 1,000m^2, is redolent with a strong odour of pesticides as are two other 100m^2 **sites at Mai Himet in zoba Northern Red Sea.**

Sprayers

The inventory of MoA stores recorded 5,411 sprayers, both functional and non-functional. The majority appear in poor condition and it is estimated that less than 30 per cent are currently usable.

Empty containers

The total number of empty containers are 12,168 pieces of different holding capacity as per the table 10..

Table 10 Empty pesticides containers

	Number of Empty Containers			
	>= 5 L	**>= 5 L and <= 25L**	**>= 25 L and <= 200 L**	>= 200 L
Northern RS	**202**	**94**	**9**	118
Southern RS	**932**	**2**	**3**	3
Anseba	**866**	**29**	**1**	21
Gash Barka	**5,426**	**19**	**10**	87

Maekel	**1,824**	**330**	**1**	395
Debub	**2,234**	**66**	**53**	82
Total	**10,845**	**540**	**77**	**706**

The condition of these containers is generally poor, with accretions of pesticide residue. It appears that only a small proportion would be suitable for recycling.

Pesticide stores

The pesticides stores around the country generally do not conform to standards recommended by FAO (Table 10). Some of the stores are general purpose buildings that have been rented by the MoA and thus lack the design features of a dedicated store. The quality of the buildings is poor with subsidence and cracking noted in many walls. There is a general lack of maintenance, with walls, roofs, gutters and windows all broken. The sites of many of the stores are not ideal: 96 per cent located within or close to human settlements and 51 per cent located close to sources of water.

Store management is also an issue with most stores being used to stock other agricultural inputs such as seeds, fertilizers, tools and sprayers. Obsolete and usable pesticides are stored together and generally, there is insufficient space to segregate the various materials adequately. Once the obsolete stocks and unusable equipment have been removed, the additional space could allow storage conditions to be improved. The organizations responsible for the stores are shown in *Table 11*.

Table 11 Store conditions

Stores	***Number of Stores***	
Stores without a lockable door or with incomplete walls Conditions	33	11%
Stores without a roof or with a leaking roof	55	19%
Stores without solid or impermeable floors	41	14%
Stores where other things are stored with the pesticides	242	83%
Sites without storekeepers	27	9%
Stores located close to houses and public facilities	278	96%
Stores where public complain about smells	57	20%
Stores located close to water sources	147	51%

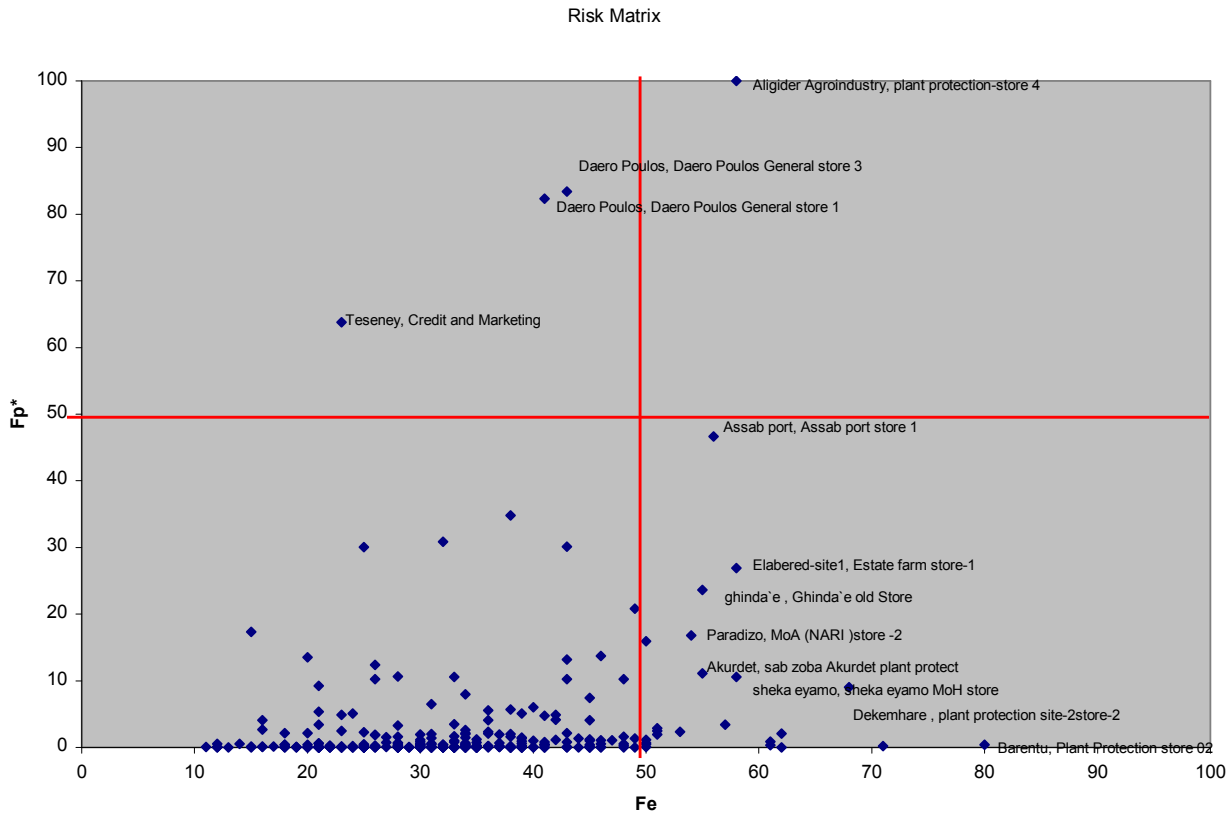
Table 12 Organizations responsible for the stores

Organisation responsible for the Store	*Number of Stores*	*Prioritized for Risk Factors*
Commercial Farms	7	
Abandoned Contaminated sites	6	
MoA Marketing and Credit	42	
MoA Plant Protection	80	7
MoA Veternary	43	
MoH	61	
Others	12	1
Parastatal Farms	21	2
Private Suppliers	18	
Total	**290**	**10**

Risk assessment of stores

The FAO has developed the Environmental Management Tool Kit (EMTK) which includes a comparative risk assessment tool that is based on objective criteria. The tool uses an environmental questionnaire about the store conditions with the score for each question weighted according to its importance. This questionnaire is included in the inventory forms and OPMS (http://opms.fao.org/OPMS/resources.htm). The total environmental risk score for the store is given the symbol Fe (risk factor for environmental condition) which has a maximum score of 100. Similarly, there is a score for the risk posed by each of the pesticides in the store based on its toxicity, whether it is leaking or not, and its quantity. The sum of all the scores of its pesticides gives the store's total risk factor for pesticides (Fp). The unlimited Fp scores are normalised to a score out of 100, given the symbol Fp*. The store with the highest Fp is given an Fp* score of 100. All other stores are given an Fp* score relative to the store with the highest Fp. The scores for all the stores are plotted on the Risk Matrix as shown in Figure 3.

Figure 2 Risk assessment of stores



All stores in the top right quadrant (Fp*>50 and Fe>50) are characterized as critical and must be prioritized for early safeguarding. The stores in the top left quadrant (Fp*>50 and Fe<50) are characterized as potentially problematic due to their pesticide content. Those in the bottom right quadrant (Fp*<50 and Fe>50) are characterized as potentially problematic due to their poor environmental conditions. The prioritisation process reviews these potentially problematic stores to identify those that represent such a significant risk that they should also be prioritized for early safeguarding. The remaining stores are a lower priority and can be safeguarded on a regional strategy that is discussed further below.

Identification of critical and potential problematic stores

In terms of risk, the following sites are listed as critical or problematic according to the risk calculations described above (Table 13).

Table 13 List of critical or problematic sites

Zoba	Site	Store	Reason
Gash-Barka	Aligider Agro industry	Plant protection-store 4	Contaminated soil with strong odour; 19,000 kg of leaking or completely broken containers of unknown obsolete pesticides; store in populated area; people complain about odours; store does not have complete walls and floors are not impermeable. **Critical**
Maekel	Daero Poulos	Daero Poulos General store 3	50 tonnes of obsolete pesticides (class II and III); store is located in a populated area; people complain about odours. **Prioritized**
Maekel	Daero Poulos	Daero Poulos General store 1	8.5 tonnes of unknown obsolete pesticides and 30 tonnes of leaking malathion and chlorpyrifos. The leaks are permeating through the walls; the store is located in a populated area. **Prioritized**
S. Red-Sea	Assab port	Assab port store 1	8.8 tonnes of unknown material that *might* be pesticides in torn sacks out in the open with no guard; store is located in a populated area. **Reassess following sample analysis**
Gash-Barka	Teseney	Credit and Marketing	The store houses 59 tonnes of pesticides of which 56 tonnes are 10 years old. 2,4-D which is one of the chemicals that the MoA are continuing to use limited leakage. Croplife will test 2,4-D for usability; Store is located in a populated area. **Reassess following confirmation on usability**
N. Red-Sea	Ghinda'e	Ghinda'e old Store	The store contains 5.8 tonnes of unknown pesticides thought to include 4 tonnes of lindane. All stocks are leaking and the consequently the building is contaminated; store is located in a populated area; people complain about odours; store has no roof and rain washes contamination out through the door. **Prioritized**

Zoba	Site	Store	Reason
Anseba	Elabered-site1	Estate farm store-1	The building is contaminated; The store contains 9,600 kg of pesticides of which 9,200 kg are obsolete; 7,200 kg of obsolete pesticides are leaking with 1/3 of it being Class II; store is located in a populated area; people complain about odours; store has no roof; walls and floors are permeable. **Prioritized**
Maekel	Paradizo	MoA (NARI)store -2	The store is an ISO shipping container that contains 4,504 kg of pesticides all of which is obsolete and 605 kg are leaking and contaminating the underlying soil; it is located in a populated area; people complain about odours; The store is located close to a water source/body; The floor of the store is permeable. **Prioritized**
N. Red-Sea	Massawa	Port Authority	Two ISO shipping containers in poor condition holding 48 tonnes of Actellic (marine pollutant) close to the harbour. **Prioritized**
Gash-Barka	Akurdet	Sub zoba Akurdet plant protection	The store contains 3.3 tonnes of pesticides of which 2 tonnes are unknown and leaking, the remainder is obsolete. Store is located in a populated area; people complain about odours; The store is located close to the Barka river and there is evidence of pesticide run-off into a gully that feeds the river. **Prioritized**
Debub	Sheka eyamo	Sheka eyamo MoH store	The store contains 2,832 kg of pesticides of which 2,520 kg are thought to be DDT and 300 kg requires testing. The store is located in a populated area and people complain about odours. It is also located close to a water source/body and near storage of food and feedstuff. **Reassess following sample analysis**

Zoba	Site	Store	Reason
Debub	Dekemhare	plant protection site-2 Store-2	The store contains 3.4 tonnes of DDT all of which is leaking. The store is located in a compound adjacent to a family's kitchen and the family complains about odours. The adjacent office has been sealed to prevent access. The store is also located close to a water source/body. **Prioritized**
S. Red-Sea	Harsile	Harsile Store	This abandoned and unsecured store contains 3 tonnes of obsolete pesticide including 80 kg of phostoxin and lies at the confluence of two spate rivers that flood in the rainy season. The main water source for the city of Assab is within 100 metres. **Prioritized**
Gash-Barka	Barentu	Plant Protection store 02	A single 200 litre drum of unknown material is 25 per cent full and is standing under the eaves of the store. **Not-prioritized**

The order that these stores are to be safeguarded is a function of the risk that they pose, together with efficiency for logistics. The map in Figure 4 shows the location of the critical sites.

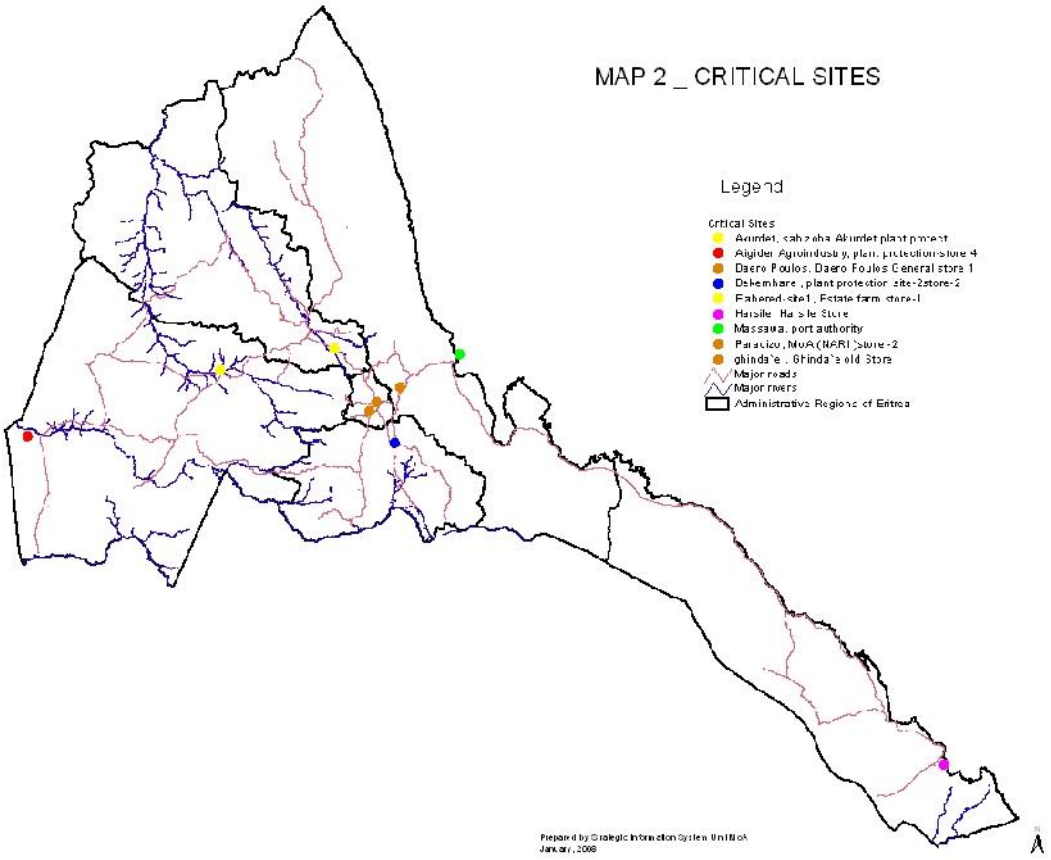


Figure 3 Location of critical or problematic sites

Other stores to be prioritized

The comparative risk analysis has identified 10 stores that should be prioritized for safeguarding. To improve the efficiency logistics and safeguarding activities, there are advantages in safeguarding sites that are adjacent or very proximate to the main prioritized sites. A review of the global positioning system (GPS) coordinates of all the stores has identified a further 17 sites that should also be prioritized. These stores are shown in Table 14.

Table 14 Prioritized sites

Zoba	*Site, Store*
Anseba	Elabered-site2, Estate farm store 1
Anseba	Elabered-site2, MoA store 2
Anseba	Elabered-site2, Estate farm, store 3
Anseba	Elabered state farm, veterinary clinic
Anseba	Elabered-site1, Estate farm store 2
Anseba	Elabered-site1, Estate farm store 4
Anseba	Elabered-site1, Estate farm, store 3
Debub	Dekemhare, Health Center, Store 2
Debub	Dekemhare, MoH Site 1, Store 1
Debub	Dekemhare, Plant Protection, Site 1, Store 1
Gash Barka	Aligider Agroindustry, Plant Protection, Store 1
Gash Barka	Aligider Agroindustry, Plant Protection, Store 3
Maekel	Daero Poulos, Daero Poulos General Store 2
Maekel	Daero Poulos, Daero Poulos General Store 4
Maekel	Paradizo, MoA (NARI) store 1
Maekel	Paradizo, MoA (NARI) store 3
N. Red-Sea	Ghinda'e, Ghinda'e M&C

2.3.2. PCBs (Annex A, Part II)

2.3.2.1. Background

Polychlorinated Biphenyls (PCBs) are a class of synthetic organic chemicals with 209 different congeners that are mostly chemically inert (stable). PCBs have been used for many applications in industry since their discovery more than eight decades ago. The most common uses of these were in the power industry in electrical equipment such as transformers, capacitors and switch gears as coolants and lubricants. Other products like hydraulic oil, carbon-less paper and adhesive also contained PCBs. Over the years, many of the materials containing PCBs have been taken out of production and use, with the exception of some electrical equipment.

Despite their useful properties, PCBs have been found to be toxic, resist degradation, bio-accumulate and bio-magnify. They are transported through the air, water and migratory species across international boundaries and deposited far from their place of release. Some negative health effects are associated with exposure to PCBs; these include: chloroacne, liver disorders, and potential reproductive effects such as deformation of newborns, low sperm counts and cancer.

The Eritrean Electric Cooperation (EEC) is the sole owner of electrical equipment in Eritrea and there are about 4,250 transformers and 240 capacitors within the country. According to EEC, most of the transformers in use are new due to replacement of the electric power system from 5.5 KVA to 15 KVA during the establishment of a new power plant at Hirgigo in 1998. This power plant covers 80 per cent of the electric power supply of the country. Most of the transformers used between 1957 and 1976 are out of use and are stored in Tsaeda Christian Girar or Denden sub stations.

The Tseada Christian store is the largest store for electrical equipment and contains most of the decommissioned and stand-by transformers as well as capacitors. However, it was estimated that about 550 decommissioned and stand-by transformers were placed in open areas and thus exposed to rain and sunlight. The level of knowledge and awareness on harmful effects of PCBs on human and environmental health is low among relevant stakeholders, industry and

the public. The second largest store in Eritrea is the Girar power station found in Massawa port, around 115 km away from Asmara. About 270 decommissioned transformers were found stored here. The third largest store is Denden camp in Asmara, which stores 50 American transformers containing PCB oil in a fenced, open site. Most of these transformers are one-phase and were manufactured by the American company KHL. The trade name Askarel is also used for some of these transformers, indicating the presence of pure or a mixture of PCBs.

Above, Denden and Girar substation decommissioned transformers

Scope of the inventory

The POPs PCB inventory included all electrical equipment, such as transformers, capacitors and oil circuit breakers, located at the EEC and decommissioned transformers and capacitors found throughout the country.

Methodology

The UNEP Guideline on Inventory of PCB (2002) was used for conducting the POPs PCB inventory in Eritrea by visiting sites potentially storing PCB-containing equipment. For identification of units potentially containing PCB-contaminated oil, 1982 was used as a reference year due to the manufacture cut-off associated with this year. Thus, units manufactured in 1982 or earlier were considered to contain PCB-contaminated oil, and samples were taken unless the unit oil was labelled as 'oil natural, air natural' (ONAN). An ONAN label implies that the transformer does not contain PCB oil).

Sampling and screening of the units were carried out by the laboratory of the Water Resources Department Laboratory using the L2000 analyzer. Collection of samples included different transmission transformers, distribution transformers, stand-by transformers and a capacitor.

Screening of PCB via L-2000 analyzer in water resources laboratory

2.3.2.2 POPs PCB inventory results

Results of the POPs PCB inventory showed that 1,000 pieces of electrical equipment were found in power plants and substations. Transformers, capacitors and oil circuit breakers were found in all distribution centres in all *zobas* of Eritrea. Based on the assessment criteria, a total number of 376 transformers containing 45 tons of oil were assumed to possibly contain PCB-contaminated oil. Regarding capacitors, a total number of 240 units containing 0.018 tons of oil were found and assumed to contain PCB due to its viscous behaviour. No sample was taken for circuit breakers because most of the units stored at the Eritrean electric corpration use Dialla B as oil. One soil sample from a spillage was taken at Denden Substation, but no PCB concentration could be detected.

Taking samples and reading plate on Girar substation by PCB task teams and contaminated soil in Girar substation.

Table 15 Inventory results of equipment containing PCBs in Eritrea

Country electrical equipments		Transformers			Capacitors		
Total amount of equipment		Number or pieces	Total weight in tons	Dielectric weight in tons	Number Or pieces	Total weight in tons	Dielectric weight in tons
	In operation	3,000	1,762	309	120	0.72	0.006
	Standby	250	77	19	45	0.27	0.006
	Decommissioned	1,000	2,295	565	75	0.45	0.006
	Total	4,250	4,134	893	240	1.44	0.018
PCB containing	In operation	0	0	0	120	0.72	0.006
	Standby	1	0	0	45	0.27	0.006
	Decommissioned	375	681	45	75	0.45	0.006
	Total	**376**	**681**	**45**	**240**	**1.44**	**0.018**
PCB distribution by concentration	>= 50 and <= 500 ppm	327	593	39			
	>500 and <= 2000 ppm	36	66	4			
	> 2000 ppm	12	22	2	240	1.44	0.018

2.3.2.3. Gap analysis and limitations of the POPs/PCBs inventory

- It was very difficult to access all the decommissioned transformers because they were located in congested areas.
- Not all transformers and capacitors could be identified due to missing name plates and labelling systems.
- There was a shortage of sampling equipments which led to difficulties in conducting sampling at some sites.
- No health and environmental assessment has been carried out in relation to PCB and PCB-containing equipment.

2.3.2.4. Conclusions

- Most of the transformers being used by the EEC are new.
- All the transformers made between 1930 and 1980 were purchased from the Italian company Ansaldo SanGeorgio (Sace Bergamo, Italy).
- There is no legal regulation on PCB and PCB-containing equipment.
- There is a possibility of cross-contamination of the new transformers to soils near by the Eritrean Electric Corporation due to poor chemical management and handling of decommissioned transformers.
- Knowledge, awareness and environmental and human health risks associated with PCBs and PCB-containing equipment could not be assessed during this study.

- At most stations, oil containing PCBs is municipally disposed into drainage systems and those stations which have storage facilities sell the oil as a source of furnace fuel to local individuals.
- There is no facility for regeneration or reclamation of the oil containing PCB in Eritrea.
- Since 1982, the kind of transformer oil being used by EEC is Dialla-B.

2.3.2.5. Recommendations

- The knowledge- and awareness-raising programme should be promoted to inform all EEC workers about the health and environmental risks associated with oil containing PCB.
- Safety appliances, including wearing safety cloths such as lab coats, glasses and gloves, should be introduced at each station to protect the health and safety of workers who are handling oil containing PCB.
- The EEC should draft a management scheme on the environmentally sound management of used oil containing PCBs.
- A separate collection tank is required to collect used oil containing PCBs. It also needs to reach unauthorized collection points.
- An environmental legislation shall be drafted to have a legal basis for any actions related to PCB management in Eritrea.

2.3.3. DDT (Annex B)

The Assessment in relation to Annex B chemicals (Dichloro Diphenyl Trichloroethane or DDT) was conducted together with that of POPs pesticides described in Part 2.3.1 titled: “Assessment with respect to Annex A, part I chemicals (POPs pesticides): historical, future production, use, import and export.

In general, not much information is available within other ministries/departments in Eritrea, on the past imports of DDT. It is, therefore, difficult to establish the true amount of DDT imported into Eritrea. However, available documents state that DDT is imported and is being used in the country since 1970 by the MoH and MoA to control insect pests of medical importance, namely mosquitoes and midges and to control bedbugs and head lice. There is however, no recorded information available on the export of DDT in Eritrea.

Currently, the Malaria Control Unit of the MoH is the only importer of DDT in Eritrea. DDT is used only for public health, particularly for vector control and complies with WHO’s position and the Stockholm Convention. Generally, the indoors (IRS) spraying is done in selective villages of two

zobas (Gash Barka and Debub) and the decision is taken annually on epidemiological basis. There is no any available recorded information on the export of DDT in Eritrea.

2.3.3.1. Scope of the DDT inventory

The inventory includes both active and obsolete DDT in stores of the MoH and MoA in all *zobas* of Eritrea.

2.3.3.2. Methodology used in inventory of DDT

The methodology used is the same as of pesticide POPs, which is physical inspection and questionnaire survey.

2.3.3.3. Results of the DDT inventory

The amount of DDT from 33 locations of the ministry hospitals, health centers, stores and plant protection stores is summarized in table below. The total amount of active DDT found in the stores in different parts of Eritrea was 13,321 Kg and 38,801 Kg for obsolete DDT.

Table 16 Dichlori Diphenyl Trichloroethane (Obsolete DDT)

Zoba	Administration	Site Name	Store Name	Total quantity (Kg)
S. Red-Sea	Areta	MoH HQ site	Store-2	1,625
S. Red-Sea	So. Southern Red-Sea	Assab	MOH HQ Store2	1,625
N. Red-Sea	Mitswa`e City	Massawa	Massawa Hospital	337
Gash Barka		Mulqi	Health Center	321
Gash Barka	La`Elay Gash	Awgaro	Health Centre Store 1	642
Gash Barka	Mensura	Mensura	Health Centre Store 1	160
Gash Barka	Dghe	sub *zoba* dghe Mogoraib Health Centre	Mogoraib Health Centre Store 1	375
Gash Barka	Teseney	MoH sab *zoba* teseney	Health Centre Store-2	455
Gash Barka	Omhajer	MoH sub *zoba* Golij Omhajer health center	Omhajer Health Centre	128
Gash Barka	La`Elay Gash	Tokombia	Tokombia Health Centre	375

Gash Barka		MoH Golig sub *zoba*	MoH Golig sub *zoba* Health Centre	899
Gash Barka	Forto	MoH sub *zoba* Forto	Health Centre	302
Gash Barka	Akurdet	Akurdet Hospital -site 4	Akurdet Hospital store1	861
Gash Barka	Akurdet	Akurdet Hospital -site 4	Akurdet Hospital store1	1,235
Maekel	Asmara City	Asmara	Asmara, Pickling tannery store	1,500
Maekel	Asmara City	Daero Poulos	Daero Poulos General store 1	2,160
Maekel	Asmara City	Adiguadad	MoH Adiguadad	14,965
Maekel	Asmara City	Adiguadad	MoH Adiguadad	434
Maekel	Asmara City	Paradizo	MoA (NARI)store -1	912
Gash Barka	Barentu	Barentu	Barentu MoH store-2	193
Debub		Maiaini	MoH Genetseba	40
Debub	Sen`afe	Sen'afe	Sen'afe MoH	64
Debub	Tsorena	Tsorona	Tsorona MoH	37
Debub	segheneyti	segheneyti	Community Hospital	300
Debub	Adi Keyh	Adi Keyh	MoH Adi Keyh	8
Debub	Dekemhare	Dekemhare	Plant protection site-2, store-2	3,400
Debub	Dekemhare	Dekemhare	Health Centre Store 2	74
Debub	Adi Quala	Sheka eyamo	Sheka eyamo MoH store	300
Debub	Adi Quala	Adi Quala	MoH Health Center	247
Debub	Mendefera	Mendefera	MoH, store2	193
Debub	May Mine	May Mine	Health Centre	128
S. Red-Sea	Areta`	Tio	Tiomini Hospital	1,023
Gash Barka	Barentu	Barentu	Barentu MOH site1 store	3,483
Total				**38,801**

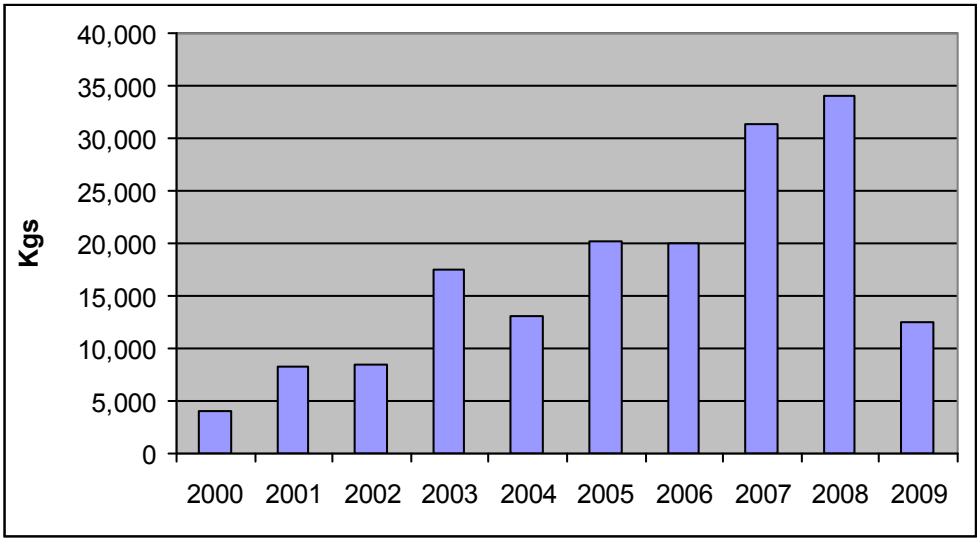


Figure 4 Annual use of DDT in Eritrea from 2000- 2009

2.3.3.4. Monitoring and evaluation

The monitoring and supervision of the use of DDT are done only on the efficacy of the DDT against the mosquitoes. No study or test has been conducted on the human health risk and the environment. The MoH Malaria Control Unit carries out a study on the efficacy of DDT against the adult mosquitoes every one or two years. The study revealed that the mosquitoes have developed a resistance to DDT and MoH is ultimately eliminating the use of DDT. The Malaria Control Unit will start to use a safer and effective alternative to DDT known by the name Lanbdacyhalothrin 10% WP and Bendiocarb 80% WP from the year 2012. The MoH has already ordered a quantity of 3,666 Kg of Lanbdacyhalothrin 10% WP (ICON 10% WP) to be imported from abroad.

2.3.3.5. Lessons learned and conclusions

- There is no risk assessment conducted in human health and environment.
- The efficacy of DDT is decreasing because the mosquitoes have developed a resistance.
- Management of obsolete DDT in some stores is poor.
- Eritrea was using DDT to control Mosquito, the malaria vector according WHO/SC exemption right and guidance.

2.3.3.6. Recommendations

- Safe, effective and affordable alternatives should be encouraged and enhanced.
- Adequate monitoring should be conducted on occupational safety and environment.
- Obsolete DDT should be cleaned up and disposed of in accordance with the provisions of the Stockholm Convention.
- Training should be promoted to storekeepers on safe handling of chemicals.

2.3.4. Assessment of Releases from Unintentional Production of Annex C Chemicals (PCDD/PCDF, HCB and PCBs)

Dioxins (polychlorinated dibenzo-*p*-dioxins or PCDD) and furans (polychlorinated dibenzofurans or PCDF) are two of the 21 POPs addressed in the Stockholm Convention. Both PCDD and PCDF are unintentional by-products of many industrial and all combustion processes. There has been a fall in these emissions since 1998.Nevertheless, other sources continue to exist. Identified potential sources of PCDD and PCDF in Eritrea are waste incineration, power generation and heating, uncontrolled combustion processes, production of mineral products, ferrous and non-ferrous metal production, production of chemicals and consumer goods, transport and miscellaneous.

2.3.4.1. Scope of the inventory

The inventory on dioxins and furans includes all the source categories and processes known to release PCDD/PCDF that are listed in Annex C, Part II and III of the Stockholm Convention.

2.3.4.2. Methodology

The survey used the standard questionnaire provided in the Standardized Toolkit for Identification and Quantification of PCCD and PCDF release developed by UNEP. Additionally, secondary data from relevant ministries were used.

Table 17 Overview of the national releases of PCDD/PCDF in Eritrea

		Annual releases (g TEQ/a)					
Category	**Source categories**	**Air**	**Water**	**Land**	**Product**	**Residue**	**Total**
1	Waste incineration	1.1	0.0	0.0	0.0	0.0	1.1

2	Ferrous and non-ferrous metal production	0.4	0.0	0.0	0.0	0.0	0.4
3	Heat and power generation	2.3	0.0	0.0	0.0	0.0	2.3
4	Production of mineral products	0.3	0.0	0.0	0.0	0.0	0.1
5	Transportation	0.0	0.0	0.0	0.0	0.0	0.0
6	Uncontrolled combustion processes	167.0	0.0	180.7	0.0	0.0	347.7
7	Production of chemicals and consumer goods	0.0	0.0	0.0	0.0	0.0	0.0
8	Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.1
9	Disposal/landfill	0.0	0.0	0.0	0.0	0.0	0.0
10	Identification of potential hot-spots		0.0				
	Total	**17.1**	**0.0**	**180.7**	**0.1**	**0.0**	**351.8**
Grand Total		**352**					

The team has visited 121 potential sources and quantified total 352gmTEQ/annum releases of PCDD and PCDF into air water, land, and product and residue as shown in the table-17 above.

2.3.4.3. Process classifications and source quantification

Waste Incineration

The incineration of waste is categorized according to the types of wastes being burned as listed in 1.1-1.7. In this context, incineration means destruction in a technological furnace of some sort. However, in Eritrea there are no waste incineration facilities for municipal wastes, hazardous waste, sewage sludge, waste wood and biomass and combustion of animal carcasses.

Nevertheless, there are very old technologies used as incinerators in some referral hospitals where there is no temperature regulator and Air Pollution Control Systems (APCS).

Akurdet referral hospital incinerator The result of the inventory indicates that annual emission for waste incineration is about **1.1g-TEQ/annum**

Ferrous and non-ferrous metal production

The iron and steel industry as well as the non-ferrous metal industry are highly material and energy intensive. Eritrea does not have the industrial capacity to produce zinc, iron, brass, copper, magnesium and lead; it has the industrial capacity to undertake iron ore sintering, coke production and aluminium production.

Iron ore sintering

There are two facilities in Eritrea that use secondary scrap metal melting, using waste oil for burning. The oil drips into the furnace and air is provided by a draft fan. There is no air pollution control device, and exhaust gases enter the warehouse and exit through the windows and holes in the walls.

- About 90 tons of cast iron, zinc and aluminium are processed annually.
- Both facilities use old technologies with no APCS.
- There is no temperature control
- The total emission from the iron ore sintering plant stands at 0.002 gm TEQ/annum

Coke production

There is no coke production in Eritrea. However, a similar product, i.e. charcoal is produced. There are many non-licensed traditional industries in Eritrea for charcoal production. They produce about 125,150 tons of charcoal annually. Here too, similar issues as above are observed.

- Use of old technologies with no air pollution control systems
- No temperature control

- The total emission from coke production plant is 0.385 gm TEQ/annum

Charcoal for sale

Aluminum production

There is one industry in Eritrea that processes scrap aluminium and produces about six tons of aluminium annually. However, the emission of PCDD/PCDF is insignificant.

Overall, the result of the inventory indicates that annual emission for ferrous and non-ferrous metal production is about 0.4 g-TEQ/annum.

Power generation and heating

This category includes power stations, industrial firing places (furnaces) and installation for providing space heating, fired with fossil fuels and biomass. The main release vectors are air and residue.

Fossil fuel and power plants

Heavy fuel is used to generate electric power in all parts of the country. Generators use light fuel only when the engine starts. Most of the engines are very old and they tend to consume very high amounts of heavy oil, thus the release of the PCDD/PCDF from power generation is significant. The total emission from power generation is 0.006 g-TEQ/annum.

Biomass power plants

Some small scale factories use clean wood as a source of energy in their engine. The total emission from biomass power plant is 0.139 g-TEQ/annum.

Household heating and cooking (biomass)

Biomass such as virgin wood is used for household cooking in most rural areas in Eritrea and its contribution to PCDD/PCDF release is significant. Emissions from household heating and cooking stand at 2.025 g-TEQ/annum.

Landfill, biogas combustion

There is no power generation practices from land fills at present, however there is a potential of such techniques in the future.

Virgin wood for domestic cooking consumption

Domestic heating (fossil fuels)

Cooking with fossil fuels (charcoal, kerosene and LPG) has been included in this section. The total emission from fossil fuels is 0.139 g-TEQ/annum.

Overall, the result of the inventory indicates that annual emission for power generation and heating is about 2.3 g-TEQ/annum.

Charcoal sacks being loaded. Charcoal is used as a domestic cooking fuel.

Production of minerals

This category involves high-temperature processes for melting (glass, asphalt), baking (brick, ceramics), or thermally induced chemical transformation (lime, cement). Unwanted by-products emitted in these fuel combustion processes generate PCDD/PCDF. The formation of PCDD/PCDF is also linked to the type of raw materials used.

Cement production

Currently, there is one only cement producing factory in use in Port Massawa. It has an electric arc furnace equipped with electrostatic precipitators. Cement is produced here by grinding

clinkers with gypsum. Emissions of PCDD/PCDF have been associated with the production of clinkers at high temperature. As there is no advanced emission control system in place, bag filters are used as an air pollution control measure, leading to potentially high releases of PCDD/PCDF. The total production of this cement factory is 25,000 tons per year, contributing to an emission of 0.125 g-TEQ/annum. A new cement factory has also been established in Massawa port with a high production capacity, however it has yet to commence operations and is therefore not included in the inventory.

Lime production

There are about 50 traditional lime factories in the country. All lime producing plants use old technology with no APCS. The amount of wood used is about 25,000 kg per cycle. One cycle usually lasts between six to eight weeks. The lime factory produces 13,463 tons per year contributing 0.135 g-TEQ/annum in PCDD/PCDF emission.

Traditional lime plant and lime production

Brick production

Most brick factories in Eritrea use old technology (modified shaft kilns) with no APCS. leading to potentially high emission rates of PCDD/PCDF. In all 39,726 tons of bricks are produced annually, and the process contributes emissions of 0.008 g-TEQ/annum.

Asphalt mixing

The country has two asphalt mixing plants (Asbeco and Gedem Construction). However, a negligible amount of asphalt is processed and thus the emission of PCDD/PCDF is insignificant. Moreover, both plants are equipped with bag filters.

Transportation

The transportation sector too emits very insignificant amounts of PCCD/PCDF since the country has very limited Vehicles.

Uncontrolled combustion processes

Uncontrolled combustion processes are a high potential emission source for PCDD/PCDF. This category includes biomass burning, waste burning and accidental fires. According to the National Inventory on PCDD/PCDF, dioxin and furan emissions from uncontrolled combustion processes are mainly a result of landfill burning and uncontrolled domestic waste burning (composed of solid waste generated and burnt in towns and rural areas of the country).

Based on a study conducted by the MoLWE, daily waste-generation per household stood at 2.2 kg in 2007. As an average family had five members, it was assumed that urban households generate 0.4 kg/person/day waste and non-urban areas generate about 0.3 kg/day/person. Further, based on the estimation that 1.5 million people live in urban areas and 2.5 million in villages, it was estimated that 50 per cent of the waste in urban areas was burnt; in non-urban areas, this ratio was assumed to be 70 per cent. The release of PCDD/PCDF was calculated based on these assumptions. Uncontrolled domestic waste burning and landfill burning is the major (99 per cent) contributor to PCDD/PCDF releases into air and land, amounting to 166.992 gm TEQ/annum and 180.676 g-TEQ/annum respectively.

Open biomass burning (i.e. forest and grassland fire) releases PCDD/PCDF into air and land amounting to 0.04 g-TEQ/a and 0.03 g-TEQ/a, respectively. Statistics on accidental fires in vehicles are included and their release of PCDD /PCDF into air and land is 0.005 g-TEQ/annum and 0.001 g-TEQ/annum respectively. With regard to accidental household and commercial fires however, an estimation of the amount of material burned is not feasible.

Asmara: a dumping site and a forest fire.

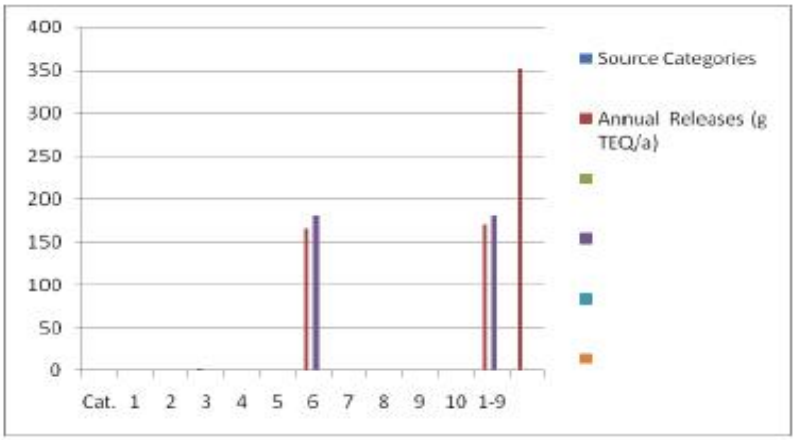
2.3.4.4. Production and use of chemical and consumer goods

Eritrea has no chemical-producing industries. However, there are four small plastic factories which use PVC. The production capacity of these factories is so small that their potential PCDD/PCDF emissions are insignificant.

Miscellaneous

There is only one cigarette factory in the country producing about 4,917,000 tons of the Pall Mall brands of cigarettes produced per year. Because of unavailability of data, the inventory team didn't include imported cigarettes even though there are many cigarette brands illegally imported into the country.

Drying of biomass and dry cleaning were also included in the inventory, however the emission of PCDD/PCDF from these two categories was found to be insignificant. .



Disposal/Landfill

Figure 5 PCDD/PCDF releases from different source categories

The following findings emerged with regard to dioxin and furan release from disposals and landfills: the amount of landfill leachate couldn't be quantified; average sewage generation was estimated at 20 kg/day/person taking the total to 1,095,000 tons per annum. There was and is no sewage treatment and in urban areas, sewage is dumped into open water. There are no centralized composting plants in the country.

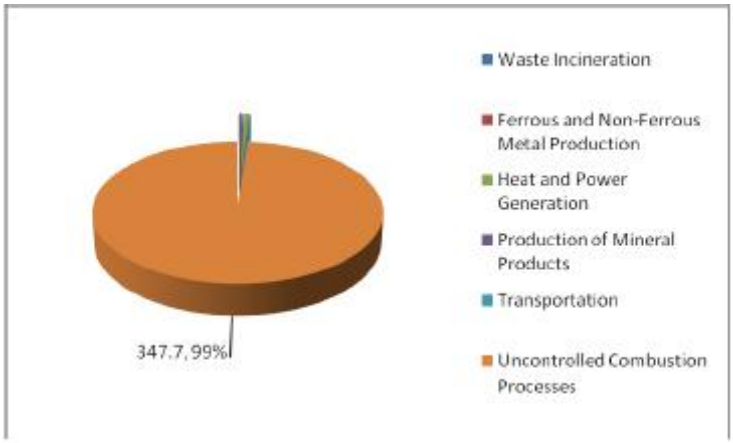


Figure 6 PCDD/PCDFs releases from each source category

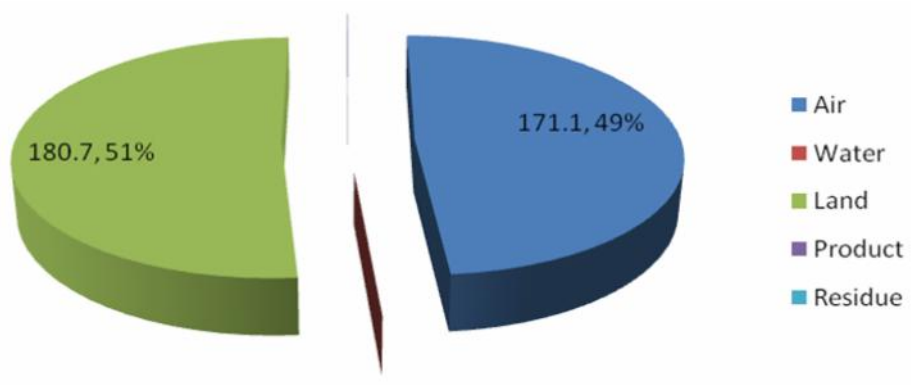


Figure 7

PCDD/PCDFs releases into different media

2.3.4.5. Gap analysis and limitations of the dioxin and furan inventory

- Data was limited as was information related to dioxin and furan emissions.
- There is a gap in knowledge about all industrial processes leading to dioxin and furan production.
- No assessment could have been done on the human health and the environment.

2.3.4.6. Lessons learned and conclusions

- The largest source of emissions for furans and dioxins is the uncontrolled domestic waste burning which contributes about 99 per cent of the total emission.
- The second-largest source of emissions for furans and dioxins is heat and power generation.

- There is a low level of awareness and knowledge about the production of dioxins and furans and their harmful effects on health and environment among the public and plant owners.

2.3.4.7. Recommendations

- The introduction of BATs and BEPs for environmentally sound management of the dioxin and furan releases should be promoted.
- Efforts to reduce open burning such as reusing, recycling, composting, modern sanitary land filling and incinerating should be promoted.
- Alternative energy sources should be introduced into the country and especially expanded to rural areas.

2.3.5. Contaminated Sites

A contaminated site is defined as one in which substances occur at concentrations above background levels, or at concentrations above levels specified in legislations, and pose or are likely to pose an immediate or long-term hazard to human health or the environment.

2.3.5.1. Scope of the inventory

This survey of contaminated areas considered three categories of POPs with a high potential for causing widespread contamination: PCBs, POPs pesticides including DDT and PCDD/PCDF.

2.3.5.2. Methodology

The methodology used included a literature review, field visits and a standard questionnaire. The team visited stores with decommissioned transformers, DDT stores run by the MoH and the Escarico dumping site. Secondary data from an inventory of contaminated sites conducted in 2007 under a FAO project was also used.

2.3.5.3. Results of the inventory

Preliminary inventory and assessment of POPs contaminated sites, stockpiles and wastes, revealed 17 potentially contaminated stores/sites. The identification of these sites followed visual inspection, assessment and expert judgment. All sites with leaking units were considered to be sites that will potentially become contaminated in the future, if mitigation measures are not instituted urgently.

Contaminated area in Girar Power plant

The 17 severely contaminated sites have been recommended for priority action and clean-up in the first five years of NIP implementation.

Table 18 Summary of the priority areas possibly contaminated with POPS

Site name	**Weight in Kg**	**Contaminated Area in** m^2	**Contaminant**
Tsaidachristain substation		60	PCB
Denden camp		25	PCB
Barentu MoH store		38.58	DDT
Decamhare MoA	3400		DDT
Shegeneiti MoA		5	Heptachlor
Girar substation		50	PCB
Massawa old airport		100	Unknown
Shekaeyamo MoH	2520		DDT
Ghindea MOA		40	Unknown
Aligider Agroindustry,		100	Unknown
Assab port		40	Unknown
Ghinda'e old Store	4000 kg lindane &5800 kg unknown		Lindane and Unknown
Akurdet, plant protection		10	Unknown
Asmara		500	PCDD/PCDDF
Gejeret substation		10	PCB
Akurdet substation		20	PCB

The national inventory conducted in 2007 under the umbrella of FAO for all obsolete, unwanted and banned pesticides indicated that 21 locations with a total surface area of 1,400m^2 were identified.

2.3.5.4. Lessons learned

- There is a lack of capacity for management, control and monitoring of contaminated sites.
- There is no knowledge on the potentially adverse effects posed by POPs-contaminated areas.

2.3.5.5. Recommendations

- The contaminated sites should be cleaned up.
- Tangible management provisions should be introduced.
- Awareness of the workers or the population has to be raised.
- Remediation options for contaminated sites should be introduced.

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

Eritrea is not producing or using any POP pesticides as of now. The situation is likely to continue, thanks to actions by various actors to promote substitutes and alternative approaches such as IPM. Likewise, DDT is another substance that has never been produced in Eritrea, though the nation uses up to 15 tons of it per annum. It is only used for vector control, specifically malaria since 1986 and its use is restricted to endemic areas. There has not been any systematic monitoring of DDT in the country.

There is no production of PCBs in the country; all the equipment and oil that contain PCBs were imported. Equipment and contaminated materials identified as having a PCB content greater than 50 ppm are addressed in the NIP for sound disposal. There has not been any production of POP substances in the country. The status is not expected to change during the coming years.

2.3.7. Existing Programmes for Monitoring Releases, and Environmental and Human Health Impacts, including Findings

There is a lack of sufficient and reliable data or records on the effects of POPs on human health and environment in Eritrea. However, recognizing that POPs have a tendency to bioaccumulation in fatty tissues of living organisms, the following groups are considered to be most at risk from POPs: pesticide sprayers and storekeepers as well as people living near pesticide stores, who

are all affected by releases from stockpiles. Pesticide storekeepers, especially women, are the most vulnerable to POP releases from stockpiles.

The indoor spraying of DDT for malaria control constitutes one of the highest releases of POPs in the country. DDT is currently sprayed in 12 sub-*zobas* out of total 54 sub-*zobas.* Information on the health and environmental effects of releases from PCBs as well as from dioxins and furans is not available. Gaps in monitoring POPs release include the following:

- No clear internal arrangement and reporting system on POPs issues.
- No monitoring standards.
- No institutional capacity.

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

Several information dissemination pathways exist that could be utilized for dissemination of POP information. Some of these include print media, radio, television, seminars/workshops/meetings, school curricula, and environment clubs. However, the majority of Eritrea's population is not well informed about POPs and their harmful effects on human health and the environment. It is only recently that a very few sectors of the population came to learn of their harmful effects. What is known so far about POPs is their application in industry and agriculture and particularly their benefits in controlling insects, animal pests and infectious diseases.

Since the inception of the project on developing the NIP on POPs, awareness workshops were held for a variety of professionals and the larger public. Workshops on the national inventory, assessment of POPs, and validation of POPs priorities in Erirtea have been carried out. Participants from NGOs, representatives of government organizations, stakeholders and individuals attended the above workshops which enabled them to obtain information on the types and effects of POPs. National study tours conducted by experts during the POP inventory provided the opportunity to transfer knowledge to city municipalities, health staffs, hospitals and industries in major towns of the country.

As proof of its obligations, the Government of Eritrea has signed various environment related conventions, including the Stockholm Convention in March 2005, and has since then put in place various mechanisms that facilitate the protection and preservation of the environment. There is, however, a lack of focused effort to tackle the issue of POPs particularly relating to information,

awareness and education, compared to other environmental areas. Awareness programmes were very few.

As a result, very few people are aware of POPs related issues and of their adverse environmental and health impacts. The media is also not providing enough information to the public in a manner that is understood by all. There is, therefore, an urgent need for capacity building in this area. Even though several ministries have public relations officers or Information Communication and Education Sections in place, there is not much public involvement in the decision-making process. The Convention also lays emphasis on non-confidentiality of health and safety related information on POPs – again there are no defined policies to provide the public with this information.

The following gaps were identified from the survey undertaken on POPs.

- Lack of well-coordinated information dissemination channels.
- Lack of database on POPs.
- Lack of POPs management guidelines.
- Lack of awareness programmes specifically for POPs.
- Limited information on the availability of BAT and BEPs to minimize POPs releases.

2.3.8.1. Recommendations

- Establish a body for coordinating public awareness/education programs on POPs.
- Train trainers for dissemination of information to different target groups.
- Incorporate POPs as a subject in the school curriculum.
- Develop guidelines on POPs management
- Acquire resource documents and set up a centralized documentation centre on POPs for public access.

2.3.9. Relevant Activities of Non-governmental Stakeholders

Article 7, paragraph 2 of the Convention encourages Parties to consult their national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their plans.

Article 10, paragraph 1/d says that each Party shall promote "public participation in addressing persistent organic pollutants and their health and environmental effects and in developing

adequate responses, including opportunities for providing input at the national level regarding implementation of this Convention".

In order to meet these requirements of the Convention, the NIP should contain a brief inventory on the current activities and expertise of NGOs in the field of POPs. Two NGOs have been identified, which do not deal specifically with POPs but are indirectly involved in the POPs issue. These are the Chamber of Commerce and National Confederation of Eritrean Workers. The following are the participating sectors.

Table 19 Non-governmental stakeholders

Stakeholder	Sub-sector	Involved in implementation of inventory?
WFP		N
DLCOEA		Y
Toker Community Development	NGO	Y
NCEW		Y
NUEW		Y
NUEYS		Y

Table 20 Local and private stakeholders

Organization	Sub-sector	Holder?	Involved in implementation of inventory?
Private Importers	Ajeca, Concersio, Red Sea Trading Company, Asmara Pest Control, Agri Union, International Agrochemicals, Afro Pest Control	Y	N
Wholesalers & retailers	Ajeca, Concersio, Red Sea Trading Company, Asmara Pest Control, Agri Union, International Agrochemicals, Afro Pest Control	Y	N
Formulators	One company that has ceased trading	Y	N
Fumigators (Pesticide Applicators)		Y	Y
Air strip owners		Y	N

The following table provides an overview of stakeholders directly involved in developing controls under NIP for POPs pesticides, including assigned responsibilities:

I = Stakeholder to keep informed.

1st = Stakeholder responsible for executing task assigned.

2nd = Stakeholder essential to provide support and facilitate implementation of task assigned.

Table 21 Overview of stakeholders involved in the pesticides inventory

		Inventory			Safeguarding			Disposal		
S.N	**Organization**	**I**	**1st**	**2nd**	**I**	**1st**	**2nd**	**I**	**1st**	**2nd**
1	**Government Organizations**									
1.1	MoA		√			√			√	
1.2	MoLWE			√			√			√
1.3	MoH			√			√			√
1.4	Ministry of local Government	√					√	√		
1.5	Ministry of Labour & Human Welfare	√					√			√
2	**Commercial Farms**									
2.1	Alla Farm	√			√			√		
2.2	Barka Farm (Wedi Legess)	√			√			√		
2.3	Gash Farm	√			√			√		
2.4	Fekadu Farm	√			√			√		
2.5	Labelle-4 Asmara flowers	√			√			√		
2.6	Mai Ainy Farm	√			√			√		
2.7	Shemshemia Farm	√			√			√		
3	**Parastatal Farms**									
3.1	Asmara Flowers	√			√			√		
3.2	Sawa Afhimbol	√			√			√		
3.3	Elabered Estate	√			√			√		
3.4	Hidri	√			√			√		
3.5	Sirihit *zobas*	√			√			√		
4	**International & Regional Organization**									
4.1	FAO		√			√			√	
4.2	WFP	√			√			√		
4.3	UNDP	√			√			√		
4.4	UNHCR	√			√			√		
4.5	DLCO-EA	√			√			√		
5	**Private Pesticide Importers & Dealers**									
5.1	Consorzio Agrario	√			√			√		
5.2	Asmara Pest Control	√			√			√		
5.3	Union Agricultural Inputs	√			√			√		

		Inventory			Safeguarding			Disposal		
S.N	**Organization**	**I**	**1st**	**2nd**	**I**	**1st**	**2nd**	**I**	**1st**	**2nd**
5.4	Universal Engineering & Services/International Agrochemical	√			√			√		
5.5	Ageca	√			√			√		
6	**Private Veterinary Drug Dispensers**									
6.1	Berhane Farm (Asmara)	√			√			√		
6.2	Lemma't Drug (Mendefera)	√			√			√		
6.3	Barka Drug (Embaderho)	√			√			√		
6.4	Feven Drug Retailers (Serejeka)	√			√			√		
6.5	Legechwa Drug (Dubarwa)	√			√			√		
6.6	Semhar Drug Retailer (Adiquala)	√			√			√		

2.3.10. Overview of Technical Infrastructure for POP Assessment, Measurement, Analysis, Alternatives and Prevention Measures, Management, Research and Development – Linkage to International Programmes and Projects

Eritrea has no accredited laboratory equipped for analyzing POPs; it also lacks proper equipment for monitoring PCDD/PDDF emission levels. None of the higher academic institutions, NGOs and public health institutes have been involved in environmental and/or health studies related to the exposure of POP chemicals. Thus, there is high demand for studies dealing with POP chemical exposure, especially among industrial workers and locals who live near industrial areas. Investigating residue levels of POPs especially pesticides, in food, air, soil and water samples hasn't been done due to the unavailability of laboratory equipment and poor human resource capacity.

2.3.11. Identification of Threats to Human and Environmental Health; Implications for Workers and Local Communities

No assessment has been done to determine impact of POPs on local populations. However, Eritrea has yet to eliminate obsolete pesticides (generally organoclorine pesticides), PCBs and other POPs. It has not taken measures to control PCDD/PCDF releases. The presence of POPs places the Eritrean population and the environment at potential risk. Given the widespread lack of awareness on the harmful effects of DDT, obsolete pesticides, contaminated sites, stockpiles and wastes scattered across the rural areas, farmers, cattle and wild animals residing in the vicinity of POPs are at greatest risk.

DDT is sprayed in 22 sub-*zobas* in Eritrea, especially in *zoba* Gash Barka and *zoba* Debub. The number of people exposed to indoor spraying of DDT is 93,302 in *zoba* Debub and 84,460 in *zoba* Gash Barka. Personnel who spray the DDT also fall in the high-risk category because they don't take proper precautions during spraying. Decommissioned transformers in Denden camp release PCBs, placing the local population of around 5,000 at high potential risk. Technicians, who handle/ repair this electrical equipment without any protective clothing, have been directly exposed to skin contact with PCBs. Scavengers, who frequent the Scarico dump site in Asmara on a daily basis, where there is spontaneous burning, are highly exposed to emissions of PCDD and PCDF.

It is known that any fire generates PCDD and PCDF, and firemen are the most exposed to the smoke. Municipal fire brigade workers are thus at risk because of their exposure to PCDD/PCDF in fires. These firemen have never been examined to record the PCDD/PCDF levels in their blood.

Biomass is the mainstay of household energy supply in rural areas and some urban areas of Eritrea. It is burnt at home for cooking and as a source of light. Thus the rural population in general and mothers and infants in particular are openly exposed to PCDD/PCDF emissions. The Maibela stream is reported to supply water to Asmara's farms which grow and sell vegetables such as lettuce, carrots and cabbage to several markets in the city catering to a large portion of the population in Asmara.

2.3.12. Details for Any Relevant System for the Assessment and Listing of New Chemicals

There are no mechanisms based on a systematic approach towards assessment and listing of new chemicals in the country. However the MoA, in collaboration with the MoLWE, has developed Legal Notice No. 114/2006 that includes a Pesticide List as an Annex. This list was made depending on the efficacy, efficiency and toxicity of pesticides with regard to human health and the environment. This document also lists 81 pesticides cleared for import into Eritrea. Of the 21 POPs, only DDT and endosulfan are allowed to be used under restriction.

However, Legal Notice No. 114/2006 needs to be reviewed and updated since some of the pesticides in the list are banned, and new, effective and safe pesticides are currently available in the market. Moreover, the implementation of this Legal Notice on the ground needs to be strengthened. Furthermore, there is an urgent need to establish a system for assessing and listing of new pesticides and chemicals with the collaboration and coordination of all stakeholders. This system will enable Eritrea to shift to new pesticides and chemicals that have better efficacy, efficiency and lower toxicity. It will also allow the continuous assessment of pesticides in use and the screening out of those which are too toxic for human health and the environment.

3. Strategy and Action Plan Elements of the NIP

3.1. Policy Statement

3.1.1. Eritrea's Commitment to Address POP Issues

The Government of Eritrea is committed to addressing POPs issues. Eritrea has ratified the SC in recognition of the adverse effects of POPs on human and environmental health, both nationally and globally. It has also developed the present NIP in close cooperation with UNIDO and FAO, to demonstrate how Eritrea will address the POPs issue and how the country will implement the requirements set out under the Convention.

Subsequent to the ratification of the SC and related international conventions, Eritrea has taken the following steps towards meeting its commitments under the Convention and the development of the NIP.

- Establishment of the POPs focal points and National Steering Committee;
- Holding of an Inception Workshop on POPs for high- level commitment;
- Conducting a training workshop on POPs chemicals;
- Carrying out a preliminary inventory and assessment of POPs chemicals and assessing the national capacity, infrastructure and legal infrastructure to manage POPs chemicals;
- Prioritizing national POPs issues and objectives and developing national action plans in order to address the national POPs issues; and
- Finally carrying out an endorsement workshop of the final document in the presence of all stakeholders.

3.1.1.1 National NIP goal and policy objectives

As stated in the SC, the overall goal of the NIP is to protect human and environmental health from the harmful effects of POPs at the national and global level by reducing and/ or ultimately eliminating the use and release of POPs in accordance with the requirements under the SC and national sustainable development objectives and strategies. The specific policy objectives of the NIP will also apply for Eritrea as follows.

- Develop national legislation to regulate, control, reduce and eventually eliminate the import, use and production of POPs chemicals in Eritrea;
- Establish appropriate institutional mechanisms to regulate the impact of POPs on human health and the environment and strengthen enforcement capacity of such institutions;

- Strengthen national capacity and infrastructure to enable the country to adequately address the requirements under the SC and the implementation of the NIP;
- Identify and promote the application of BATs and BEP to enable the reduction and eventual elimination of POPs chemicals particularly from unintentional sources;
- Promote the establishment of research and development centers in order to search for alternatives to the use of POPs chemicals and to address their effects on human health and the environment;
- Create public awareness on the requirements of the SC and ensure the participation of the public
- Establish appropriate mechanisms for adequate data collection, exchange and dissemination and information management system for POPs chemicals.

Procedure for formal NIP endorsement

The development of the NIP requires the participation and high-level commitment of stakeholders, NGOs, academic institutions and the public. Thus, the current NIP has been presented – prior to its endorsement – at a stakeholder workshop for participants from all relevant national and regional government agencies, the private sector, NGOs, academia and research institutions. Finally, the stake holders approved and officially endorsed the NIP and the remaining is to be submitted to the government for formal endorsement and transmission to the SC Secretariat.

3.2. Implementation Strategy

3.2.1. Coordinating Mechanism for NIP Implementation

An analysis of the institutional arrangements existing in Eritrea reveals that there are a number of ministries and departments that can contribute to the successful implementation of the NIP in Eritrea. Since POPs issues are multi-sectoral, the Steering Committee was composed of a wide range of representatives from relevant government and non-governmental institutions, and shall ensure the participation of other sectors such as civil society and the private sector for effective execution of the NIP action plans and post-NIP projects. The Steering committee meets biannually to undertake the following activities.

- Review the progress and effectiveness of the implementation of the NIP based on impact indicators ;
- Determine further actions that are needed for improving the NIP implementation process;

- Provide, review and update information concerning the NIP, especially with respect to its action plans. The action plans will have assigned responsibilities for different stakeholders for which they are responsible.

The coordination and implementation mechanisms and structures described above can be modified by the Steering Committee, if necessary. Memoranda of Understanding (MoU), are encouraged, with respect to assigning responsibilities and mandates among different stakeholders.

3.2.2. Implementation Approach and NIP Priorities

Each institution designated to implement specific action plans shall develop their own detailed action plans, including work plan, specific tasks and activities required to meet the objectives specified in this document, in line with the time-frame provided.

Table 22 Main priorities of the NIP in Eritrea

Priority areas	Objectives
Institutional and regulatory strengthening	• Professionally led Import/ Export mechanisms of chemicals including POPs in place, • Control mechanism for discouraging illegal import/ export of chemicals, including POPs • Laboratories capacity for POPs analysis are in place • Trainings are conducted on POPs • Risk management of POPs is developed • Capacity Building (training, laboratory facility, offices, office equipments, etc) is provided
Public awareness, information and education at all levels	• Public is aware of the health effects of POPs • Public is actively and responsively participating in protecting the environment from POPs • Information exchange is strengthened • Healthier environment achieved
Integrated approach of all concerned institutions and stakeholders on POPs issues	• Synergy on cross-cutting issues among governmental organizations is in place • Effective and efficient information sharing system concerning POPs and chemicals
Environmentally sound management and disposal of PCBs and PCB-containing equipment	• Updated inventory database • Environmentally sound storage of PCB-containing equipment • Gradual phase-out and disposal of PCBs • Contaminated sites identified and managed in an environmentally sound manner
Reduction of unintentional POP	• Improved solid waste management policy • Open burning activities discouraged

releases with a primary focus on open burning activities	• Public awareness on unintentionally produced POPs (uPOPs)_
Identification and removal of stockpiles of Annex A Part I chemicals, including from contaminated locations	• POPs pesticide stocks identified, quantified and disposed of • Contaminated locations contained, reclaimed, or cleaned up
Reduced POPs impacts on human health and environment	• Health and environmental impact assessment and analysis carried out • High level of occupational safety in place at workplaces where POPs are present
Technical and financial assistance	• Bilateral and multilateral financial resources accessed • Technical assistance for POPs management received
Effective monitoring, research and development concerning POPs	• Research programmes for POPs management • Monitoring of POPs impacts on Environment is performed

3.3. Activities, Strategies and Action Plans

3.3.1. Activity: Institutional and Regulatory Strengthening Measures

Strengthening institutional and regulatory mechanisms to manage, monitor and control POPs is fundamental to addressing national POPs issues. However, the basic assessment of the legal and institutional framework on POPs has identified several gaps and limitations which restrict proper POPs management. The major challenge is the lack of national legislation for the management of all POPs, including a lack of standards and safety instructions for workers handling POPs in Eritrea. Another major limitation in proper POPs management is the lack of a legal framework on information gathering, public awareness raising and knowledge exchange. The goal of the action plan on institutional and regulatory framework strengthening measures is to develop and enforce a legal framework for the proper management of POPs.

Table 23 Institutional and regulatory strengthening measures

Objectives	Activities	Timeframe	Responsible institution	Stake-holders	Costs (US$)
Strengthened legislation on POPs chemicals	• Review and update existing legislation relevant to POPs; • Promulgate the draft environmental law and other relevant sectoral legislations	January 2013-December 2013	MoLWE	Customs Private sector MoTI MoMR MoBM MoJ MoA MoH MoLHW MoTC NGOs	50,000
Guidelines and standards developed for management of POPs chemcials	• Adopt standards; • Develop standards for regulations; • Develop standards for the official methodologies for POPs; • Develop and/or adopt guidelines and standards; • Training and awareness raising on the guidelines; • Perform awareness raising programs	June 2013-June 2014	MoLWE	Municipality Private sector MoMR Chamber of commerce MoA MoH ESI MoBM MoLHW MoTC NGOs	100,000
Strengthened institutional framework with clear mandates and coordination mechanism at all national	• Establish responsible body for POPs management; • Strengthening regulatory enforcement	June 2013-December 2013	MoLWE	Municipality; Private sector MoMR Chamber of commerce	100,000

levels	agencies; • Formulate ToRs.			MoA MoH ESI MoBM MoLHW MoTC NGOs	
Strengthened technical infrastructure for POPs management	• Upgrade and accredit laboratory for the detection and analysis of POPs	January 2014-January 2016	MoLWE	MoMR MoA MoH ESI MoBM NGOs	100,000
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**Jan 2013**			
Duration of action plan implementation		**3 years**			
Total cost		**350,000**			

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

3.3.2.1. Goal and objectives

Article 3 of the SC requires Parties to take legal and administrative measures to reduce or eliminate releases from intentional production and use of POPs. Results of the inventory showed that no POPs are intentionally produced in the country; however, the presence of POPs pesticides, industrial chemicals and DDT was confirmed by the inventory exercise.

3.3.2.2 Activities

Legal measures related to reducing and eliminating releases from intentional use of POPs are elaborated in sections 3.3.1., 3.3.3, 3.3.4., 3.3.5. and 3.3.6.

3.3.3. Activity: Production, Import and Export, Use, Stockpiles and Wastes of Annex A PoP Pesticides (Annex A, Part 1 Chemicals)

3.3.3.1. Goal and objectives

The overall goal of this action plan is the elimination of the use, import, stockpiles and wastes of Annex A POPs pesticides. The specific objectives of this action plan are to eliminate the production, import and export of stockpiles and waste of POPs pesticides in an environmentally sound *manner.*

*3.3.3.*2 Areas of implementation

The overall goal of the action plan is to reduce risk to human health and the environment from POPs pesticides, e.g. using a safeguarding strategy, including the disposal and storage of POPs pesticides, stockpiles and waste in an environmentally sound manner; strengthened capacity for pesticide life cycle management, building human resources capacity (raising awareness and education).

Table 24 Production, import, export and use of stockpiles

Objectives	Activities	Timeframe	Responsible institution	Stake-holders	Costs (US$)
Legal measures to eliminate the production, import and export, stockpiles and waste of POPs pesticides	• Prepare chemicals legislation (part of environmental law); • Finalize the drafted pesticide legislation and regulation taking into account the national pesticide list	April 2012-December 2012 March 2012- March 2013	MoLHW MoA	MoH; MoLHW MoF (CD); MoJ; Private pesticide dealers	100,000
Develop safeguarding strategy for obsolete pesticides	• Prioritization of safeguarding stores; • Training in risk	May 2012-December 2012	MoA	MoH MoLHW	450,000

and contaminated materials and sites	assessment, safe working methods; • Prepare health, safety and environmental management plan; • Undertake safeguarding;			EIS MoTI	
Interim storage established to properly manage stockpiles and wastes of POPs	• Identify appropriate storage sites; • Construct 3000m2 of interim storage; • Upgrade or construct standardized stores.	March 2012-December 2014	MoA	MoPW MoLWE MoLG	2,500,000
Appropriate human resource capacity for POPs pesticides management	• Training of field managers, operators and workers on safeguarding, storage management and transport • Training of staff of relevant institutions on the management and control of POPs pesticides and chemicals	September 2012-December 2014	MoA	MoH MoF EIS Agro industries Farmers; Private pesticide dealers; MoLWE	50,000 5,000
POPs pesticides, stockpiles and waste are disposed of in an environmentally sound manner	• Establishing of a disposal mechanism for POPs pesticides, contaminated containers and packing materials; • Establishing mechanism for disposal of contaminated sites; • Establish a mechanism for re-using of contaminated	September 2012-December 2014	MoLWE	MoH MoLHW EIS MoTI; MoJ; MoLG; Private pesticide dealers	Determine later

	sprayers			MoA	
Monitoring program for POPs pesticides releases from stockpiles and wastes	• Monitoring costs and budget; • Monitoring of obsolete pesticide stocks; • Monitoring of operation procedures	December 2012-December 2014	MoLWE	MoA MoH; MoLHW EIS; MoTI; MoF (CD) MoJ	50,000
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**May 2011**			
Duration of action plan implementation		**3 years**			
Total cost		**4,855,000**			

3.3.3.3. Developing a National Safeguarding Strategy

The entire management process of the disposal of pesticides relies on the three key activities of inventory, environmental assessment and safeguarding. Separate technical guidance is provided by FAO for the management of the inventory process and for safeguarding activities. A guideline is available to assist countries in the development of a disposal strategy based on specific inventory data and the selection of the most appropriate technologies for the environmentally sound management of chemical wastes. The principal guidelines available to stakeholders involved in an obsolete pesticide disposal project are the EMTK volumes 1, 2 and 3. EMTK 1 focuses on the inventory process; EMTK 2 focuses of the selection of collection centres needed for the consolidation of obsolete pesticides, sound management of these centres, and development of transport plans to ensure safe delivery of stocks to the centres or a final disposal facility; and EMTK 3 focuses on development of the CESA and EMP for high-risk sites.

However, it has been decided that an EMP will be developed for each site. Site-specific management plans will be developed for high-risk sites. For low-risk sites, two generic EMP will be developed, one for sites with a “Go and Pack” strategy and the other for sites with a “Pack and Go” strategy. It will be the responsibility of the field managers of the safeguarding teams to review

and adapt EMPs in light of the circumstances that they find at the store. The EMP will include sections on the following.

- Command structure and reporting formats.
- Task-based risk assessment procedures to identify prioritisation of safeguarding activities and risk mitigation measures.
- Site set-up including security fencing, signage, screening, zoning, storage for equipment and repackaged stocks, and site waste management.
- Safe operating procedures.
- Equipment.
- Emergency procedures: briefing local emergency services, evacuation plan, first aid post including emergency showers.
- Transport routes.

The prioritisation of safeguarding activities on high-risk sites aims to reduce the national risk posed by the stockpiles as quickly and safely as possible. The EMTK describes how the National Risk Factor or NRF can be quantified. The NRF is defined as the sum of the Fp scores for all the stores normalised to 100. To recap, these steps in the national safeguarding plan are as follows.

- Sample and analyze pesticides and contaminated materials with unknown active ingredients to determine the true risk of these materials. As unknowns, they are assumed to be highly hazardous (WHO Class Ia) with 100 per cent active ingredient concentration. By restating the Fp of the stores with the actual Fp values, the NRF will reduce to its true level and the store prioritisations can be confirmed.
- Safeguard the 10 critical sites and the 17 that have also been prioritised because they are proximate to them.
- Safeguard the other un-prioritised stores based on the regional risk factors of their ICCs.

The NRF starts at 100 and reduces to zero as the stores are safeguarded. Figure 7 shows how the NRF reduces as the national safeguarding plan is implemented. It will also be important to plot the reduction in risk against time, based upon the time expected to safeguard each store. This chart would show a far steeper exponential reduction of NRF. The actual risk reduction can be monitored against the safeguarding plan by using these charts. The development of the national safeguarding strategy is based on the following principles.

- Preparation of an EMP for each critical site and a generic EMP for all other non-prioritised stores.
- Repacking obsolete pesticides into new containers such that the risk of exposure to them is significantly reduced.

- Making the original store safe by removing contamination; if it is not possible to remove contamination, taking steps to prevent its further dispersal into the environment and to prevent exposure of people and animals.
- Moving the repacked materials to a store that is well situated, and is in a good condition so that stocks can be stored safely until their final disposal.

The safeguarding strategy proposed for Eritrea follows the recommendations from the EMTK. The strategy has been developed using the following methodology:

- Identify stores that are appropriate to be used as centres for the collection of safeguarded stocks – Intermediate Collection Centres (ICC) and one Central Collection Centre (CCC).
- Rehabilitate these stores if necessary.
- For each of the 290 pesticide stores:
    - Determine which ICC to use based on logistical efficiency, safety and avoiding risks to environmentally sensitive areas.
    - Determine the transport route.
    - Determine where the repackaging activity will take place:
        - at the store itself, in the case where the containers are not fit for transport ("pack and go"); or
        - at the ICC or CCC ("go and pack") where the original containers are safe for transport.
    - Determine who should undertake the safeguarding based on the complexity and risks posed by the materials and the condition of the store. The options are:
- for stores with high risks of exposure to highly toxic pesticides or where the structure of the store is unsafe, use a specialist contractor to undertake the complex tasks;
- for stores with a medium risk of exposure and where the structure of the store is sound, use local staff under the supervision of the contractor; and
- for stores with a low risk of exposure, use local teams trained by the contractor or specialist trainers.

In the case of the stores in Eritrea, it is planned to engage a specialist contractor to train local staff. The first stores to be safeguarded will be used as training for the local staff under close supervision of the contractors. It is likely that the four stores at Daero Poulos General Store 1, Elabered Site 1, Estate Farm Store 1, and Ghinda Old Store will require the contractors to make the sites safe before local staff could be called in to assist. All other stores should be suitable for well-trained local teams.

Prioritisation for safeguarding

The order in which the 290 stores will be safeguarded is based upon reduction of national risk as fast as possible. The national strategy is outlined below.

- For all prioritised stores, including those prioritised for logistical efficiency:
    - safeguarding will begin with the most severe (at Alighidir) in terms of risk. The other prioritised stores will be tackled based on logistical efficiency, e.g., Akurdet and Elabered are on the road back to Asmara from Alighidir so would be tackled next.
- Un-prioritised stores:
    - the remaining stores represent much lower risk so safeguarding them can be conducted on a regional basis, with all the stores in a region being safeguarded before the safeguarding teams move to the next area;
    - these stores will be tackled on a regional basis depending on their ICC. The ICC with stores that cumulatively represent the highest risk will be tackled first, followed by the stores of the ICC that cumulatively represent the second highest risk, etc.; and
    - the regions have not been demarcated based on *zoba* boundaries because they do not necessarily reflect the most efficient logistics. The regions have been based around the most efficient and safe logistical routes for getting the pesticides from the store to its chosen ICC.

The ICC for each store has been selected on the basis of minimising risks in transport and avoiding sensitive areas. The remediation of contaminated soils will be outside the scope of capabilities of the local teams and will require a specialized intervention. Local teams will be trained to safeguard and an external disposal provider will be hired to move repackaged materials to the final disposal point. Repackaged material will be warehoused in Asmara until all safeguarding activities are completed countrywide. Disposal Contractors will then be hired to move repackaged materials by sea to the final disposal point. The port at Massawa has been identified as the place of departure from Eritrea for these repackaged materials.

Strengthen safety for workers during safeguarding activities

Workers, drivers, visitors (such as supervisors and other MoA/MoLWE staff to the site), storekeepers and contractor personnel at the work site are at highest risk of being impacted by leaked pesticides, accidental releases of pesticides, or by handling the chemicals during safeguarding activities. Emergency service personnel responding to an accident at the site can also potentially be affected if they are not trained in handling hazardous substances. Zoning of

the work site and establishing barriers to prevent the movement of people and animals through the worksite will be strictly implemented and monitored. Nevertheless, the most likely potential impacts/risks based on the inventory data during safeguarding are likely to be as given below.

- Spillage during repackaging.
- Leakage of new containers.
- Fire (due to the chemicals and condition of the store).
- Poisoning, where stores contain specific pesticides known to be highly toxic.
- Chemical reaction due to the incompatible nature of products mixed in a container.
- Work place injuries such as getting crushed cut, etc.
- Potential for theft of products.
- Release of chemicals due to civil unrest or natural disasters.

Reduction of risk to humans undertaking safeguarding activities

The main mitigation measure is to ensure that all members of safeguarding teams are adequately trained and supervised. Equipment must be of the appropriate specification, and all safeguarding activities must have an EMP including communications to the local community, site set-up with fencing and barriers, and store zoning and screening to avoid egress of contamination. A task-based risk assessment should be completed before any activity commences to ensure the appropriate selection of priority safeguarding measures, equipment and other risk mitigation measures.

Reducing spread of pesticides due to safeguarding activities

Careful site set-up techniques will be employed to avoid the spread of contamination. The site will be “zoned” into three areas: a clean zone, intermediate zone and a working zone. The EMPs will detail the management protocols and working procedures to be adopted in order to mitigate this potential increased risk. The EMPs will detail the strategies to be adopted during the safeguarding process by the country team to mitigate the potential impacts to each stakeholder group.

- Outline of:
    - the management rules;

- work procedures;
- training of staff;
- consultation process; and
- monitoring and evaluation criteria

Interim storage would be established to properly manage stockpiles and wastes of Annex A POPs pesticides until disposal.

The selection of collection centres for the consolidation of pesticide stocks is one of the primary tasks that should be undertaken when developing the safeguarding strategy and before launching the activity. The selection of the interim collection centres was done based on the EMTK prepared by the FAO and the OPMS inventory data. The EMTK provides all the information and calculation formula are needed for estimating the area requirement for storage. The selection process guarantees the safest storage conditions of the stockpiles of obsolete pesticides possible in the country. The process of selection must also guarantee transparency for the acceptance of the proposals by all stakeholders, interested and affected parties and the broader general public. The interim collection centres were selected primarily based on:

- the environmental conditions on the site where the store is located, that is the environmental factor (Fe);
- logistical characteristics, including the central location of the store for the area under consideration; and
- the size of the store.

From the pesticide material data stored in OPMS, the quantity of the different forms of pesticides can be extracted and added up to determine the total amount of each of the specific forms of the pesticides in each area. The calculation for the space required at the ICC is as below.

1. Sum of the total quantity of liquid in the stores to be consolidated at the ICC.
2. Sum of the total quantity of solids in the stores to be consolidated at the ICC.

The liquids will be decanted into 200 litre drums and four drums can be stocked on a pallet with a surface area of 1.25m^2. In the case of solids, loose powders may be repacked into flexible intermediate bulk containers (FIBC) and sometimes referred to as “Big Bags”). An FIBC cannot be double stacked without a supporting cage. Each FIBC occupies 1.25m^2 surface area. For international shipping regulations, small containers of solids must be packed into ‘open head’ 200 litre drums. Again, four drums on a pallet occupy 1.25m^2 surface areas and generally weigh 150kg each. For the sake of simplicity and erring on the side of caution, it is assumed that 600kg of solid material (loose powder or containers) will occupy a surface area of 1.25m^2.

Forklift trucks are not generally available in the stores so it is assumed that pallets of drums will not be stacked. In order to ensure that there is adequate room to lay out the stocks such that they can be checked regularly and to allow access and movement of specific stocks, EMTK recommends that at least 60 per cent of the floor space is left vacant. Using these assumptions, the space required at each of the ICCs was calculated as shown in Table 26 below.

Table 25 ICCs and number of stores to be consolidated/surface areas

Number of stores to be consolidated at each ICC						
Intermediate Collection Centre	All	Prioritised for risk factors	Prioritised for logistical factors	To be prioritised following testing	Not prioritised	Area of ICC (sqm)
Asmara	66	4	5		57	624
Assab						
Barentu	29				29	42
Dekemhare	24	1	3		20	40
Forto	26	1		1	24	103
Keren	71	2	7		62	172
Mendefera	24			1	23	98
Shieb	15	1		2	12	170
Tesseney	35	1	2		32	311
Total	**290**	**10**	**17**	**4**	**259**	

In addition to safeguarding pesticide stocks, the safeguard process will generate empty pesticide containers that will require storage and disposal. The assumption is that all pesticides will be repackaged into new containers. The resulting quantity of empty containers will be added to the known quantities of empty containers that had been identified during the 2007 inventory (Table 16).

The CCC requires a surface area of at least 1,560 m^2 for storage of repackaged obsolete pesticides. It is recommended that the store should have a surface area of 2,000 m^2 to allow for storage of other safeguarded materials. In addition, the safeguarding equipment and new containers need to be stored too. The specification for this store requires that the equipment be securely protected from the outside environment.

Two locations, Asmara and Massawa, were considered for the CCC. Massawa has the advantage that it is close to the port from where the pesticides will be shipped for disposal. However it was rejected because the climatic condition (high temperature, high humidity, and salt-laden air) will cause the drums to deteriorate rapidly. Asmara was selected for the logistical efficiency of its central location within the country and the ideal climatic conditions for storage. However, so far, no suitable store has been identified. None of the stores inventoried are appropriate. The MoA will undertake a review of its own stores and those of other institutions and ministries to identify a suitable store. If no suitable store can be found, it will be necessary to construct a new one. This would have potential benefits beyond the safeguarding and disposal project but will increase the total costs of the safeguarding project.

The following points should be considered in the selection or construction of a CCC:

- Given all the risks that could arise in the central collection store, it should at least be five kilometres away from residential areas. This is to avoid any risk of explosion, leakage and possible air pollution from leaking and volatile pesticides.
- The store should be as far as possible from environmentally sensitive areas.
- The store should be downstream of any borehole, reservoir or lake. The site should not be placed in areas that are prone to natural disasters.
- The store should be built according to established standards ensuring that all conditions are met such as impermeable walls, floor and roof.
- The store should be adequately serviced with office and washing facilities including electricity, internet, telephone, alarms, security fencing and guards.

The above mentioned points can be evaluated following the national Environmental Impact Assessment (EIA) procedures and guidelines prepared by the MoLWE. An EIA is conducted and clearance is given to the MoLWE, between 20 to 40 days from submission of an application to build the CCC structure. The detailed design and layout of the store to be built should be presented in advance, in order to cross-check the local environmental conditions.

3.3.4. Activity: Capacity Building of Human Resources

3.3.4.1. Safeguarding

The field managers, supervisors and operators will be trained in all the aspects that underpin an effective safeguarding operation including: understanding and adapting the EMP; site set-up and zoning; command structure; working areas; notices; task-based risk assessment, PPE selection and use of PPE; first aid and emergency response; equipment – safe use and maintenance; safe operating procedures for repackaging; reading labels; international maritime dangerous goods

regulations, specifications for packaging materials and labelling; and communications with stakeholders.

3.3.4.2. Store management

Field Managers, supervisors, and storekeepers will be trained in all aspects that underpin effective store management. These include mixing materials – consolidating; container selection; labelling; stock management including disposition of stocks in stores, compatibility of materials, first in first out (FIFO); security; emergency plan – fire, spillage, road accident, chemical reaction, antidotes, etc.; and communications with stakeholders.

3.3.4.3. Transport

Field Managers, supervisors, storekeepers and drivers will be trained in loading and stowage; transport planning and routing; telecommunications; safe transportation procedures; emergency procedures; and unloading.

3.3.5. Activity: Dispose all Annex A POP Pesticide Stockpiles and Waste in an Environmentally Sound Manner

This activity will address all the pesticides and contaminated materials that have been identified during the inventory. Each type of pesticide waste must be assessed separately to identify the most appropriate disposal option based both on environmental and economic considerations.

There are 21 sites having in total a size of 1,400 m^2 where soil has been contaminated with pesticides. It is planned that these sites will be sampled and analyzed to identify the contaminants and their concentration. The soil will be assessed for its susceptibility to various treatment techniques. Data will be reviewed to identify options for treatment, disposal or sequestration.

1. Soils with very high levels of contamination will be disposed of as if they were pure pesticides by high temperature incineration.
2. Soils that are amenable to soil washing techniques could be treated *in situ* or with a mobile soil washing plant.
3. Some simple pesticides are susceptible to biological treatment where the soil is inoculated with enzymes adapted to feeding on pesticide molecules.
4. Soils with low levels of contaminants can be sequestered from the environment by depositing it in a purpose-built containment landfill. The landfill would have to be lined with an impermeable lining to isolate the soil from the underlying strata.

5. Soils can also be sequestered by being containerised and placed in long-term secure storage.

Both sequestration options 4 and 5 will require long-term management to ensure that the landfill or storage is maintained and managed such that the soil remains isolated from the environment.

3.3.5.1 Establishing a disposal mechanism from contaminated containers and packaging

Contaminated containers and packaging can pose a threat to environment and human health, thus they have to be treated as waste. A disposal mechanism has to be developed to treat them safely. The store or surrounding area may hold empty or partially empty containers (drums, plastic and glass bottles, cans, gas cylinders, boxes and sacks) contaminated with pesticides (this could occur because after usage of the pesticide, the containers may have been returned to the store for safe keeping; or in cases where the contents have leaked out of the container). Containers and packaging can be classified into three groups.

1. Heavily contaminated with pesticide residues, such that they must be disposed of in a similar way to pure pesticides.
2. Contaminated, but amenable to treatment to allow them to be recycled or disposed of.
3. Clean, but with low levels of contamination, and suitable for recycling or disposal.

Recycling is the preferred option as it saves scarce resources. Table 16, above, shows the estimated quantity of empty containers that will be available for recycling or disposal following the safeguarding activities. This includes the number of empty containers identified during the inventory plus the empty containers that will result from repackaging activities.

3.3.5.2 Developing and implementing a Monitoring Programme for Pesticides

Monitoring cost and budget

The actual costs will be monitored against the budget to ensure that resources are being deployed effectively and efficiently. Such monitoring will also assist in identifying funding gaps.

Monitoring safeguarded obsolete stocks

Monitoring actual quantity of safeguarded obsolete stocks against the predicted quantity from the inventory will indicate the accuracy of the inventory, instances of pilferage, and will assist in securing the appropriate funds for disposal.

Monitoring safety, near misses and accidents

Regular monitoring analysis of near misses and accidents will provide an indication of the safety of the safeguarding operations. Where patterns develop, staff can be retrained or operating procedures adapted to make them safer.

Testing human blood

Regular monitoring of the blood of safeguarding staff for signs of pesticide contamination (e.g. cholinesterase inhibition) will provide an indicator of the safety and appropriateness of protective clothing and working methods. All staff should be required to undertake a blood test before commencing safeguarding work to provide a baseline indicator. It is possible that with the poor conditions of the stores, MoA staff already demonstrate indications of pesticide poisoning. Such staff should not be permitted to work until their health has returned to normal.

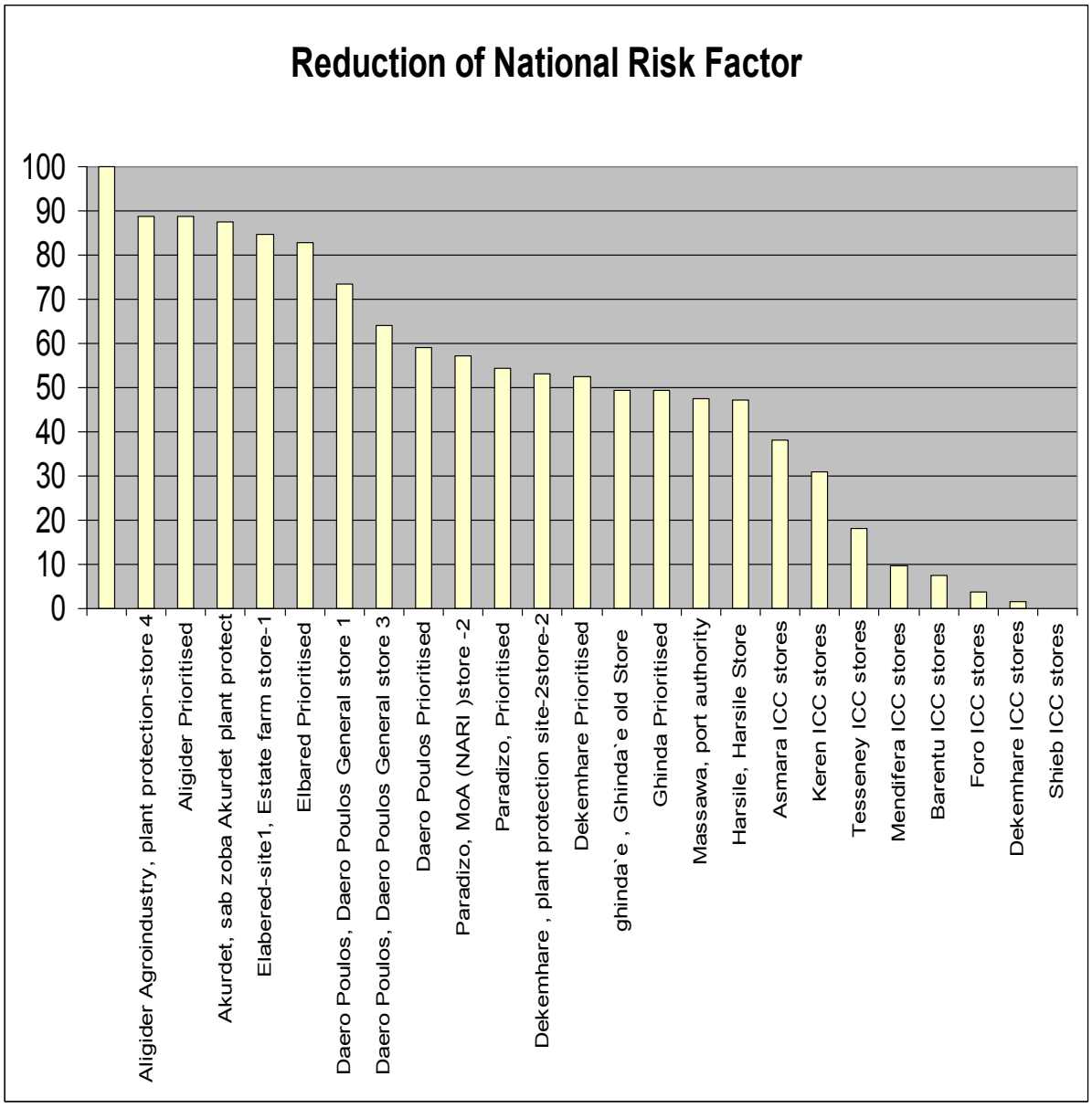


Figure 8 Reduction of national risk factor of obsolete pesticides

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

The national inventory on PCBs showed that there are about 4,250 transformers and 240 capacitors within the EEC, which is the sole owner of electrical equipment in Eritrea. According to EEC, most of the transformers in use are new while most of the transformers used between 1957 and 1976 are out of use and stored in Tsaeda Christian, Girar or Denden substations. Tsaeda Christian is the largest national store for electrical equipment. Special concerns for environmental and human health arise because 550 decommissioned and standby transformers have been placed in open areas and exposed to precipitation and sunlight. In Girar, the second largest store in Eritrea, about 270 decommissioned transformers are stored while in Denden (third largest store) about 50 PCB-containing transformers are stored in an open site. The inventory also showed that most of these transformers were manufactured by KHL (American company).

3.3.6.1 Goal

The overall goal of the action plan is the reduction and ultimate elimination of PCB releases from PCB use, stockpiles and wastes into the environment, thus reducing the risk exposed to human and environmental health.

Table 26 Production, import and export, use, identification, labelling, removal, storage and disposal of PCBs and equipment containing PCBs (Annex A, Part II chemicals)

Objectives	Activities	Timeframe	Responsible Institution	Stake-holders	Costs (US$)
Strengthened institutional and legal capacity for PCB management	• Developing legislation to require owners of PCBs to self-report and develop PCB phase-out plans; • Strengthening laboratory capacity of EEC regarding PCBs	January 2013- June 2016	MoLWE MoEM	EEC MoJ	50,000
PCB management scheme established	• Codification and labeling the PCB containing equipments; • Replacement if working PCB containing	January 2013- June 2013 2014-2025	EEC EEC	MoLWE MoEM MoF	20,000 n/d

	equipments; • Collecting used PCB-containing oil; • Identifying and selecting options for safe disposal of PCB-containing oil and waste; • Safe disposal of PCB contaminated oil and PCB contaminated equipments	2014-2026 2014-2016 2016-2027	MoEM MoLWE MoLWE		50,000 20,000 225,000 (5USD/kg PCB-contaminated oil)*
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**January 2012**			
Duration of action plan implementation		**25 years**			
Total cost		**n/d**			

3.3.7. Activity: Production, Import and Export, Use, Stockpiles, Wastes and Releases of DDT (Annex B Chemicals)

The overall goal of this action plan on DDT is the reduction, proper regulation and ultimate elimination of the use, production, import, stockpiles and wastes of DDT.

Table 27 Production, import, and export, use, stockpiles, wastes and releases of DDT (Annex B chemicals)

Objectives	**Activities**	**Timeframe**	**Responsible Institution**	**Stake-holders**	**Costs (US$)**
Evaluation mechanism for the need for specific exemptions under the SC	• Conducting periodic reviews on the continuing need to use DDT for malaria vector control in the country	Use of DDT will be discontinued as of Jan. 2012	MoLWE	MoH	n/d
Coordination organization		**MoH in collaboration with LWE**			

Expected start of action plan implementation	**Jan 2012**
Duration of action plan implementation	**n/d**
Total cost	**n/d**

3.3.8. Activity: Register for Specific Exemptions and the Continuing Need for Exemptions (Article 4)

Article 4 of the SC allows a Party to register for specific exemptions with respect to chemicals listed in Annex A or B; however, each Party using this right need to justify its continuing need for registration of the exemption. Eritrea has registered for specific exemption (DDT) on 31.5.2010. The overall goal of the action plan is to meet Eritrea's obligation under Article 4 of the SC having the following specific objectives:

Table 28 register for specific exemptions and the continuing need for exemptions (Article 4)

Objectives	Activities	Timeframe	Responsible institution	Stakeholders	Costs (US$)
Evaluation mechanism for the need of specific exemptions under the SC	Conduct periodic reviews on the continueing need to use DDT for malaria vector control in the country	Use of DDT will be discountiued as of Jan. 2012	MoLWE	MoH	n/d
Coordination organization		MoH in collaboration with LWE			
Expected start of action plan implementation		Jan 2012			
Duration of action plan implementation		n/d			
Total cost		n/d			

3.3.9. Action Plan: Measures to Reduce Releases from Unintentional Production (Article 5)

In Eritrea, the potential sources for PCDD/PCDF are waste incineration, power generation and heating, uncontrolled combustion processes, production of mineral products, ferrous and non-

ferrous metal production, production of chemicals and consumer goods, miscellaneous and transport. The national inventory of 121 potential sources resulted in the quantification of a total release of 352 gm TEQ/annum of PCDD and PCDF into air, water, and land (as described in 2.3.4.),with uncontrolled domestic waste burning being the largest source of emission. Appropriate action plans will be implemented to gather more detailed information on the production of PCDD/PCDF as well as their harmful effects on human and environmental health, low levels of analytical capacity, knowledge about PCDD/PCDF production processes and awareness about risks associated with human health and the environment.

3.3.9.1. Goal and objectives

The overall goal of the action plan is to reduce and ultimately eliminate releases from unintentionally produced POPs. The objective of this action plan is to enhance monitoring strategies, enhance public awareness and knowledge about unintentionally produced POPs and to promote alternatives, and BATs and BEPs for environmentally sound management. The action plan has the following activities.

- Develop and apply a mechanism to monitor the releases of PCDD/PCDF, HCB and PCBs;
- Update the types of sources of unintentional production of PCDD/PCDF, HCB and PCBs and their releases and develop data management systems on same;
- Strengthen public awareness and education and their integration in the decision-making process and implementation of measures;
- Promote the use of alternative methods to reduce/eliminate emissions from uncontrolled combustion;
- Promote the adoption of BAT and BEP.

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

The inventory revealed that releases from stockpiles and wastes of POPs pesticides, PCBs and DDT are a serious issue in Eritrea. However, there is a need to collect more information on the total quantity of stocks and to raise awareness on how to dispose stockpiles and waste in an environmentally sound manner. Activities related to the identification of stockpiles, articles in use and waste contaminated with POPs chemicals are described under various sections above.

3.3.11. Activity: Manage Stockpiles and Appropriate Measures for Handling and Disposal of Articles in Use

Activities related to the proper handling and environmentally sound disposal of stockpiles of 1400m^2 were contaminated. In both, the NIP development and FAO inventory study, a lack of institutional and resource capacities to manage, monitor and control contaminated sites were identified. Lack of awareness and knowledge on the potential adverse effects posed by POPs contaminated sites were another problem which needs to be addressed by an action plan.

3.3.11.1 Goal and objectives

The overall goal of the action plan is to properly manage and ultimately clean up all sites contaminated by Annex A, B and C POPs. The specific objective of this action plan is to identify, manage and reclaim sites contaminated with POPs in order to reduce human health and environmental risks exposed from POPs. The specific activities of this action plan are to:

- identify all sites contaminated by POPs;
- manage all sites contaminated by POPs; and
- reclaim contaminated sites by POPs phase by phase.

3.3.12. Activity: Facilitating or Information Exchange and Stakeholder Involvement

Exchanging information on various issues that relate to POPs at the international level with other Parties to the SC, and at the national level with different stakeholders is essential to the proper management of POPs. The SC also requires Parties to facilitate or undertake information exchange related to the reduction or elimination of the production, use and release of POPs, to the availability of alternatives and risks exposed through POPs, and to their economic and social costs. The overall goal of the action plan is to establish and maintain a viable information exchange system at the national level.

Table 29 Identification of contaminated sites with Annex A, B and C, and remediation in an environmentally sound manner

Objectives	Activities	Timeframe	Responsible Institution	Stakeholders	Costs (US$)
Legal frameworks is in place for contaminated sites	• Develop legislation required for parties related with POPs contaminated sites to self-report;	January 2013-January 2014	MoLWE	MoA/MoEM/MoJ/ MoH/EEC/municipality MoA/MoEM/MoJ/	50,000

management	• Develop legislation on the control and clean-up of contaminated sites	January 2013- January 2014	MoLWE	MoH/EEC	50,000
Mechanism is in place to identify contaminated sites	• Identify possible stakeholders contributing to POPs contamination; • Conduct workshops on contaminated sites management and identification (for the identified stakeholders); • Collect data on the POPs on the contaminated sites after visiting them	July 2013- August 2014 September 2013 for 2 day January 2013- June 2013	MoLWE MoLWE MoLWE	- Identified organizations Identified organizations	10,000 5,000 30,000
Identified contaminated sites are gradually cleaned up/containment	• Set a priority to the contaminated sites; • Monitor and evaluate by visiting the sites; • Report the progress of the sits	June 2013- January 2014 June 2014- January 2028 (every 6 month) June 2014- January 2028 (every 6 month)	MoLWE MoLWE MoLWE	MoA/MoEM/MoJ/ MoH/EEC MoA/MoEM/MoJ/ MoH/EEC MoA/MoEM/MoJ/ MoH/EEC	15,000 150,000 50,000
Coordination organization		MoH in collaboration with LWE			
Expected start of action plan implementation		Jan 2013			
Duration of action plan implementation		Until 2028			
Total cost		360,000			

3.3.13 Activity: Management and Clean-up of Contaminated Sites in an Environmentally Sound Manner

Table 30 Management and clean-up of contaminated sites in an environmentally sound manner

Objectives	Activities	Timeframe	Responsible Institution	Stakeholders	Costs (US$)
Introduction of ESM management procedures	• Develop guidelines and procedures (for emergency respondents and clean-up); • Organize consultation workshop on guidelines; • Disseminate and promote guidelines and procedures	January 2013-January 2014 January 2013-January 2014	MoLWE	MoA MoEM MoJ MoH EEC municipality	50,000 50,000
Safeguard selected contaminated sites	● Contaminated site mapping and characterization; ● Prioritization of contaminated sites; ● Immediate response measures such as fenching securing	January 2014-December 2014	MoLWE MoH MoA MoEM	MoLG Municpality Private sector	60,000
Awareness raised among workers and the general population on contaminated site issues	● Provide training for the workers; ● Organize campaign on POPs	January 2014-March 2014	MoLWE	MoLWE MoH MoA MoEM	25,000

				MoLG MoLHW	
Remediation options are introduced	● Incineration in high temperature; ● Demolition of dilapidated sites; ●Disposal			MoEM; MoLG; MoLHW	
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**January 2013**			
Duration of action plan implementation		**33 months**			
Total cost		**360,000**			

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

According to Article 10 of the SC, signatory states are required to promote and facilitate public information, awareness and education about POPs. The preliminary inventory in Eritrea revealed that the level of awareness and knowledge about POPs was very low and required measures to promote and facilitate public awareness, information and education. The overall goal of the action plan is thus to create awareness among the target groups specified in Article 10 of the SC, and also educate, enable and activate them to control and properly manage POPs. The objective of this action plan is to develop and implement information and communication systems for the management of POPs.

Specific areas covered by this action plan are:

- active involvement of the public in decision-making on POP-related issues;
- information exchange at the national, regional and international level;
- education programmes on POPs.

3.3.15. Activity: Effectiveness Evaluation (Article 16)

Article 16 of the SC requires that the CoP shall evaluate the effectiveness of the SC starting four years after the coming into force of the Convention for each party. The evaluation shall be conducted on the basis of available scientific, environmental, technical and economic information, including national reports. Each party shall generate monitoring data on the national presence of POPs listed in Annex A, B and C as well as their regional and global environmental transport. A special action plan is needed for Eritrea in order for it to meet this requirement. The overall goal of this action plan is to facilitate the evaluation of the effectiveness of the SC at the national and global level.

Table 31 Effectiveness evaluation (Article 16)

Objectives	**Activities**	**Timeframe**	**Responsible Institution**	**Stake-holders**	**Costs (US$)**
Effectiveness of the implementation of the SC in Eritrea evaluated on a periodical basis	• Update assessment of sources of POPs; • Undertake socio-economic and environmental impacts; • Assess the effectiveness of the regulatory mechanism (pesticides and PCBs) and awareness promotion measures (unintended emissions); ● Capacity building on technology transfer and human resource development	July 2013-July 2018	MoLWE	ECC, MoH, MoTL, MoLG, MoF, MoE, MoI, MoJ, Municipality, NGOs, MoA, MoLHW	500,000
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**July 2013**			

Duration of action plan implementation	**6 years**
Total cost	**500,000**

3.3.16. Activity: Reporting (Article 16)

Article 16 of the SC requires a Party to report on the measures it has taken to implement the SC and on the effectiveness of the measures taken (3.3.14). Each party is also required to provide the SC Secretariat with statistical data on POPs conducted within the country. The goal of this action plan is to meet the reporting obligations of Eritrea under the SC using the activities highlighted in Table 36 below.

Table 32 Meeting the reporting obligations (Article 16)

Objectives	Activities	Timeframe	Responsible Institution	Stakeholders	Costs (US$)
Reporting obligations of Eritrea under the SC met	• Identify stakeholders for information collection on POPs; • Database on POPs related information; • Collect and compile statistical data on use, production, import and export of POPs	January 2012 Feb-Jun 2012 August 2012	MoLWE MoLWE MoLWE	MoTI Customs MoA MoH MoEM Municpality Chamber of Commerce	25,000 50,00
Periodic reports are submitted to the SC	• Prepare and submit report on PCB phase-out; • Prepare and submit report on Annex C POPs releases; • Prepare and submit report on the use of DDT • Prepare and submit country reports on	August 2012, every 5 years; August 2012; every 5 years; Not	MoLWE	MoEM Municipality MoTI MoTC MoA MoH MoT,	5,000 5,000

	POPs; •Update NIP every four years	applicable September 2012, every 4 years March 2016			5,000 5,000
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**January 2012**			
Duration of action plan implementation		**n/d**			
Total cost		**USD 95,000**			

3.3.17. Activity: Research, Development and Monitoring (Article 11)

Article 11 of the SC requires each Party to undertake research, development and monitoring activities pertaining to POPs, alternatives and candidate POPs. In Eritrea, the preliminary inventories on POPs revealed a lack of knowledge on the impact on human and environmental health, as well as socio-economic factors. Finding alternatives to POPs, especially for DDT, is another pressing issue in Eritrea. The overall goal of the action plan is to minimize and ultimately eradicate the negative impacts of POPs by systematically monitoring their sources, investigating effects in humans and the environment and finding alternatives.

Specific activities of the action plan are to develop and promote a research, development and monitoring system for raising awareness, knowledge and education for the management of POPs. This includes an investigation of:

- the sources and releases of POPs into the environment in Eritrea;
- the level of POPs in human health and the environment in Eritrea;
- the impact on human health, as well as environmental and socio-economic impacts of POPs in Eritrea.

3.3.18. Activity: Technical and Financial Assistance (Articles 12 and 13)

Eritrea is one of the least developed countries and lacks the financial and technical capacity to successfully implement its NIP and thus meet its obligation under the SC. Eritrea is thus eligible for financial and technical assistance from the international community, which requirement it addresses with this action plan.

The overall goal of this action plan is to secure technical and financial assistance for Eritrea which is needed for successful implementation of the requirements set under the SC.

Table 33 Technical and financial assistance (Article 12 and 13)

Objectives	**Activities**	**Timeframe**	**Responsible Institution**	**Stake-holders**	**Costs (US$)**
Technical and financial assistance for the successful implementation of the requirements set by the SC secured	• Identify and assess financial and technical need for national and international assistance; • Identify potential sources for financial and technical assistance; • Collect and compile statistical data on use, production, import and export of POPs	2012-2017	MoLWE	Municipality MoA MoH MoLG MotC MoMR Private sector MoLHW	240,000 (40,000 annually)
Coordination organization		**MoLWE**			
Expected start of action plan implementation		**January 2012**			
Duration of action plan implementation		**6 years**			
Total cost		**USD 240,000**			