

# REPUBLIC OF BOTSWANA



Republic of Botswana

**NATIONAL IMPLEMENTATION PLAN (NIP)  
FOR THE  
STOCKHOLM CONVENTION  
ON  
PERSISTENT ORGANIC POLLUTANTS (POPs)**

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## ACRONYMS AND ABBREVIATIONS

<b>µg</b>	Microgram (10 <sup>-6</sup> grams)
<b>ABB</b>	ABB (A German producer of transformers)
<b>AG</b>	Attorney General
<b>AIDS/HIV</b>	Acquired Immune Deficiency Syndrome / Human Immuno Virus
<b>Al</b>	Aluminium
<b>APC</b>	Air Pollution Control
<b>APCS</b>	Air Pollution Control System
<b>APPA</b>	Atmospheric Pollution Prevention Act
<b>APRC</b>	Air Pollution Registration Certificate
<b>BAQO</b>	Botswana Air Quality Objectives
<b>BCL</b>	Bamangwato Concession Ltd
<b>BDC</b>	Botswana Development Cooperation
<b>BOBS</b>	Botswana Bureau of Standards
<b>BOTEC</b>	Botswana Technology Centre
<b>BPC</b>	Botswana Power Corporation
<b>BR</b>	Botswana Railways
<b>BURS</b>	Botswana Unified Revenue Services
<b>CBOs</b>	Community-Based Organizations
<b>CDD</b>	Chlorinated Dibenzo-p-Dioxin
<b>CDF</b>	Chlorinated Dibenzo-p-Furans
<b>Cl</b>	Chlorine
<b>COP</b>	Conference of the Parties
<b>CSO</b>	Central Statistics Office
<b>DAH &amp; P</b>	Department of Animal Health and Production
<b>DCP</b>	Department of Crop Production
<b>DDP</b>	District Development Plan
<b>DDT</b>	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
<b>DEA</b>	Department of Environment
<b>DEBS</b>	Department of Engineering and Building Services
<b>DMS</b>	Department of Metrological Services
<b>DoSH</b>	Division of Safety and Health

<b>DOT</b>	Department of Tourism
<b>DPH</b>	Department of Public Health
<b>DPP</b>	Division of Plant Protection
<b>DTRS</b>	Department of Transport and Road Safety
<b>DWMPC</b>	Department of Waste Management and Pollution Control
<b>EC</b>	European Community
<b>EIA</b>	Environment Impact Assessment
<b>FAO</b>	Food and Agriculture Organization of the UN
<b>g</b>	Gram
<b>GC/MS</b>	Gas Chromatograph / Mass Spectrometer
<b>GDP</b>	Gross Domestic Product
<b>GoB</b>	Government of Botswana
<b>GPS</b>	Global Positioning System
<b>HCB</b>	Hexachlorobenzene
<b>HRGC</b>	High Resolution Gas Chromatograph
<b>HRMS</b>	High Resolution Mass Spectrometer
<b>Hx</b>	Hexa – (six chlorine atoms attached)
<b>IFCS</b>	Intergovernmental Forum on Chemical Safety
<b>ILO</b>	International Labour Organization
<b>IRS</b>	Indoor Residual Spraying
<b>I-TEF</b>	International Toxic Equivalency Factor
<b>KCS</b>	Kalahari Conservation Society
<b>Km</b>	Kilometres
<b>LA's</b>	Local Authorities
<b>MEWA</b>	Ministry of Energy and Waters
<b>MLG</b>	Ministry of Local Government
<b>MoA</b>	Ministry of Agriculture
<b>MoH</b>	Ministry of Health
<b>MoLH</b>	Ministry of Lands and Housing
<b>MRC(SA)</b>	Medical Research Council (South Africa)
<b>NCS</b>	National Conservation Strategy
<b>NCSCA</b>	National Conservation Strategy Coordinating Agency
<b>NDP</b>	National Development Plan
<b>NEESAP</b>	National Environmental Education Strategy and Action Plan

<b>NEI</b>	Transformer manufacturer
<b>NEL</b>	National Environmental Laboratory
<b>NGOs</b>	Non-Governmental Organizations
<b>NI</b>	No Information
<b>NIP</b>	National Implementation Plan
<b>NPC</b>	National Project Coordinator
<b>O</b>	Octa – (eight chlorine atoms attached)
<b>OBT</b>	Odour Bated Targets
<b>°C</b>	Degree Celsius
<b>ODMP</b>	Okavango Delta Management Plan
<b>PCB</b>	Polychlorinated Biphenyls
<b>PCDD</b>	Polychlorinated Dibenzo-para-Dioxins
<b>PCDF</b>	Polychlorinated Dibenzo-para-Furans
<b>PCP</b>	Penta Chloro Phenol
<b>Pe</b>	Penta – (five chlorine atoms attached)
<b>POPs</b>	Persistent Organic Pollutants
<b>ppm</b>	Part per million
<b>PPP</b>	Purchasing Power Parity
<b>PVC</b>	Poly Vinyl Chlorine
<b>RNPE</b>	Revised National Policy on Education
<b>SADC</b>	Southern African Development Community
<b>SOER</b>	State of the Environment Report
<b>T</b>	Tetra – (four chlorine atoms attached)
<b>TBD</b>	To Be Determined
<b>TCDD</b>	Tetrachlorodibenzo-p-dioxins
<b>TCDF</b>	Tetrechloro dibenzo-furnas
<b>TEQ</b>	Toxic Equivalent Quantity
<b>UB</b>	University of Botswana
<b>UDP</b>	Urban Development Plans
<b>UN</b>	United Nations
<b>UNCCD</b>	United Nations Convention on Combating Desertification
<b>UNCED</b>	United Nations Commission on Economic Development
<b>UNDP</b>	United Nations Development Programme
<b>UNEP</b>	United Nations Environment Programme

<b>UNFPA</b>	United Nations Population Fund
<b>UNICEF</b>	United Nations Children and Education Fund
<b>UNIDO</b>	United Nations Industrial Development Organization
<b>USEPA</b>	United States Environment Protection Agency
<b>WHO</b>	World Health Organization
<b>WHO- TEF</b>	WHO- Toxic Equivalency Factor
<b>WUC</b>	Water Utilities Cooperation

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## EXECUTIVE SUMMARY

Persistent Organic Pollutants (POPs) are synthetic chemical substances that have toxic properties to humans and animals, are bio-accumulative in organisms through the food chains, and get transported over long-range distances from the points of their release through various environmental media such as air, water and migratory species. Their occurrence in the environment lasts for a considerable length of time. They last because they resist photolytic, chemical and biological degradation. POPs are highly toxic as they cause an array of adverse health effects, notably death, birth defects among humans and animals, cancer and tumours at multiple sites, neuro behavioural impairment including learning disorders; immune system changes; reproductive deficits of exposed individuals as well as their offspring; and diseases such as endometriosis, increased incidence of diabetes and others.

Many of the POPs have found wide use as pesticides to protect plants against diseases and humans and animals from vector-borne diseases. Some are used as heat resistant dielectrics in electrical equipment such as transformers and capacitors, while dioxins and furans are produced as by-products of incomplete combustion and chemical processes. At present, twelve chemicals have been proved to exhibit POPs characteristics. They are composed of intentionally produced pesticides (i.e. Aldrin, Dieldrin, DDT, Endrin, Chlordane, Hexachlorobenzene, Mirex, Toxaphene and Heptachlor) and industrial chemicals, which are Polychlorinated Biphenyls (PCBs) and Hexachlorobenzene. The second category is the unintentionally produced releases of certain industrial and combustion processes i.e. the polychlorinated para dibenzodioxins and polychlorinated dibenzofurans.

Because of the toxicity, persistence and distributive capacity of POPs, their strict management towards total elimination is desirable. To this end, an international cooperation and intervention is a prerogative of all nations. Countries of the world have realized the importance and need of sound management of chemicals in general, with the aim of protecting human health and environment. The management has taken the form of various international and regional instruments, principles, guidelines and codes of ethics. Some of the pertinent international fora, initiatives and conventions include, the Stockholm Convention, Basel Convention, Montreal Protocol, all of which Botswana is a party to, and is in the process of acceding to Rotterdam convention.

Botswana became party to the Stockholm Convention on the 28<sup>th</sup> October 2002. Following this status, Botswana is obliged to develop and formulate a National Implementation Plan for the implementation of the Stockholm Convention. A multi disciplinary stakeholder committee consisting government departments, non-governmental organisations, parastatals and the private sector was established to steer the NIP development.

The Stockholm Convention provides for protection of human health and environment from persistent organic pollutants (Article 1). Article 7 further states that:

*“1. Each Party shall:*

*(a) Develop and endeavour to implement a plan for the implementation of its obligations under this Convention;*

*(b) Transmit its implementation plan to the Conference of the Parties within two years of the date on which this Convention enters into force for it; and*

*(c) Review and update, as appropriate, its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties”.*

The inventory of POPs in early 2006, revealed about 80 litres of obsolete stocks of POPs Pesticides and 170.6 metric tonnes of obsolete stocks of DDT that are stored in various areas in the country. The survey of electrical equipment that use dielectric fluids based on polychlorinated biphenyls (PCBs) showed that there are about 16,570 cubic metres of oil suspected to contain PCBs in equipment in use and about 500 pieces of equipment containing PCBs. The inventory identified sources and quantified releases of Dioxins and Furans in the country. Approximately 291.833 g TEQ/a are released through air emissions and residues respectively. There was no POPs pesticides contaminated site identified in this survey, this may be so because of the evidenced low utilization of POPs pesticides for agricultural purposes. However it cannot be concluded that there is no contaminated site in the country since the survey was only based towards the Agricultural Regions whose selection was as outlined in the Inventories report. The storage site in Sebele for instance could be a potential contaminated site.

Due to the large quantities of PCB containing equipment (40 000 tonnes) and extensive use of these equipment, the number of contaminated sites could be just as high. The actual number of contaminated sites could not be determined from the inventories. The inventory revealed that the use of DDT for malaria vector control was banned in 1997, and since pyrethroids were used for malaria vector control. However Botswana will revert to the use of DDT, most likely in the next spraying season (2008), this is because DDT has proved to be more effective and has long residual effects.

There are several gaps with regard to POPs management in the country. These include:- inadequate capacity and experience for monitoring environmental, human and ecological effects caused by POPs and the management of such effects is not known yet. Few institutions have laboratory facilities and trained personnel that can facilitate monitoring of POPs and their alternatives and these need strengthening in terms of specialized training and upgrading of equipment. There is inadequate documentation system both in the private and government offices during importation, formulation and distribution of POPs chemicals; lack of awareness at all levels; lack of planned information dissemination strategy to inform the public on POPs issues; the monitoring for compliance with the legislation requirements governing pesticides including DDT is weak. Some baseline information are lacking particularly in case of PCDD/PCDF releases. Best Available Techniques (BATs) and Best Environmental Practices (BEPs) especially on management of Annex C POPs releases require appropriate coordination and reporting. There is a need to develop national environmental standards on POPs, procedures for analysis and monitoring releases, including national emission factors for PCDD/PCDF identification and monitoring.

In her endeavours to undertake early actions, this document is developed as a living document that will guide all sectors towards elimination of POPs in the country. The overall goal of NIP is to provide the road map for the protection of the health of Batswana and environment from harmful effects of POPs and Persistent Toxic Substances. Therefore the Government of Botswana through the national focal point commits itself to providing active leadership and support in the development and maintenance of appropriate procedures and measures to prevent or eliminate use, stockpiles, and wastes of POPs and to reduce unintentional releases of POPs in the environment.

The following priority areas were identified and validated through a consultative workshop of all stakeholders as part of the NIP development.

- Occupational safety measures for POPs management and use
- Education and awareness on POPs
- Appropriate legal and administrative framework
- Enhancing commitment for POPs management at the policy maker level
- Environmentally sound management of POPs, specifically PCB containing equipment and wastes
- Capacity building for enforcement and monitoring agencies including technical infrastructure for POPs management
- To achieve continuous release reduction of Annex C POPs
- Controlled use of DDT for malaria vector control
- Rehabilitation and management of contaminated sites
- Research and development to establish the level of environment and human health impacts of POPs

These are the encompassing objectives set in order to enable the country to address POPs issues in a very sustainable way. All action plans are directed towards achievement of these broader priority areas. Chapter 3.3 covers the action plans and strategies. The subsection on activities and action plans covers seventeen intervention areas. There are four major categories of Persistent Organic Pollutants identified for purposes of this document, namely, Pesticides and DDT, Polychlorinated Biphenyls and Dioxins and Furans. This section therefore outlines all relevant intervention areas under each of these categories. It should be noted that there are several cross cutting issues among all these categories, implementation of which becomes blanket, in terms of addressing POPs issues. However, each category has been dealt with independently so as to cover all pertinent issues thereof. Such cross cutting issues include policies and legislation, public awareness and education, information exchange as well as reporting. In terms of overall implementation, the time frame (implementation schedule) indicates all those overlaps.

The NIP implementation starts in 2008 and encompasses 6 years; up to 2013. The total NIP implementation is estimated to be 10.1 million US\$, which does not include the cost of disposal of PCBs. Resource requirements are elaborated in Table 51.

# 1 INTRODUCTION

## 1.1 BACKGROUND: PERSISTENT ORGANIC POLLUTANTS, HUMAN HEALTH AND THE ENVIRONMENT

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

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

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

## 1.2 THE STOCKHOLM CONVENTION ON POPs: HISTORICAL PERSPECTIVES

Aware that POPs pose major and increasing threats to human health and the environment, in May 1995 the Governing Council of the United Nations Environment Programme (UNEP) requested in its decision 18/32 that an international assessment process be undertaken of an initial list of 12 POPs (aldrin, chlordane, DDT, dieldrin, dioxins, endrin, furans, hexachlorobenzene, heptachlor, mirex, PCBs and toxaphene). The Council also requested that the Intergovernmental Forum on Chemical Safety (IFCS) develop recommendations on international action for consideration by the UNEP Governing Council and the World Health Assembly no later than 1997.

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

### **1.3 OBJECTIVE OF THE CONVENTION**

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

Botswana ratified the Convention on 28th October 2002. Ratification meant that Botswana fully commit itself to the Convention, and also launched the development and implementation of the NIP.

### **1.4 SELECTED ARTICLES OF THE CONVENTION**

Selected articles of the Convention that need specific attention are:

#### **Article 3; Measures to reduce or eliminate releases from intentional production and use**

Each Party shall prohibit and/or take the legal and administrative measures necessary to eliminate:

- Its production and use of the chemicals listed in Annex A (POPs pesticides)
- Its import and export of the chemicals listed in Annex A POPs pesticides and restrict its production and use of the chemicals listed in Annex B (DDT) for malaria vector control.

With regard to the elimination of the use of polychlorinated biphenyls (PCBs) in equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) by 2025, take action in accordance with the following priorities:

- Make determined efforts to identify, label and remove from use equipment containing greater than 10 per cent polychlorinated biphenyls and volumes greater than 5 litres;
- Make determined efforts to identify, label and remove from use equipment containing greater than 0.05 per cent polychlorinated biphenyls and volumes greater than 5 litres;
- Endeavour to identify and remove from use equipment containing greater than 0.005 percent polychlorinated biphenyls and volumes greater than 0.05 litres;

Make determined efforts designed to lead to environmentally sound waste management of liquids containing PCBs and equipment contaminated with PCBs having a PCBs content above 0.005 per cent, as soon as possible but no later than 2028.

#### **Article 4; Register of specific exemptions**

A Register is hereby established for the purpose of identifying the Parties that have specific exemptions listed in Annex A or Annex B. It shall not identify Parties that make use of the provisions in Annex A or Annex B that may be exercised by all Parties. The Register shall be maintained by the Secretariat and shall be available to the public.

#### **Article 5; Measures to reduce or eliminate releases from unintentional production**

Each Party shall implement measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination.

## **Article 6; Measures to reduce or eliminate releases from stockpiles and wastes**

1. In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a chemical listed in Annex A, B or C, are managed in a manner protective of human health and the environment, each Party shall:

- (a) Develop appropriate strategies for identifying:
  - Stockpiles consisting of or containing chemicals listed either in Annex A or Annex B; and
  - Products and articles in use and wastes consisting of, containing or contaminated with a chemical listed in Annex A, B or C;
  - Identify contaminated sites with Annex A, B or C. If remediation is undertaken, it should be carried out in an environmentally sound manner.

## **Article 7; Implementation plans**

Each Party shall:

- (a) Develop and endeavour to implement a plan for the implementation of its obligations under this Convention;
- (b) Transmit its implementation plan to the Conference of the Parties within two years of the date on which this Convention enters into force for it; and
- (c) Review and update, as appropriate, its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties.

## **Article 8; Listing of chemicals in Annexes A, B and C**

A Party may submit a proposal to the Secretariat for listing a chemical in Annexes A, B and/or C. The proposal shall contain the information specified in Annex D. In developing a proposal, a Party may be assisted by other Parties and/or by the Secretariat.

## **Article 9; Information exchange**

Each Party shall facilitate or undertake the exchange of information relevant to:

- The reduction or elimination of the production, use and release of persistent organic pollutants; and
- Alternatives to persistent organic pollutants, including information relating to their risks as well as to their economic and social costs.

The Parties shall exchange the information referred to in paragraph 1 directly or through the Secretariat.

Each Party shall designate a national focal point for the exchange of such information.

## **Article 10; Public information, awareness and education**

Each Party shall promote within its capabilities

- (a) Awareness among its policy and decision makers with regard to persistent organic pollutants;

- (b) Provision to the public of all available information on persistent organic pollutants, taking into account paragraph 5 of Article 9;
- (c) Development and implementation, especially for women, children and the least educated, of educational and public awareness programmes on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives;
- (d) 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;
- (e) Training of workers, scientists, educators and technical and managerial personnel;
- (f) Development and exchange of educational and public awareness materials at the national and international levels; and
- (g) Development and implementation of education and training programmes at the national and international levels.

#### **Article 12 and 13; Technical and financial assistance**

The Parties recognize that rendering of timely and appropriate technical assistance in response to requests from developing country Parties and Parties with economies in transition is essential to the successful implementation of this Convention. New and additional financial resources should be made available for developing countries and for countries with economies in transition to facilitate their adherence to the Stockholm Convention and their measures addressing POPs.

#### **Article 15; Reporting**

Each Party shall report to the Conference of the Parties on the measures it has taken to implement the provisions of this Convention and on the effectiveness of such measures in meeting the objectives of the Convention.

Each Party shall provide to the Secretariat:

- (a) Statistical data on its total quantities of production, import and export of each of the chemicals listed in Annex A and Annex B or a reasonable estimate of such data; and
- (b) To the extent practicable, a list of the States from which it has imported each such substance and the States to which it has exported each such substance.

Such reporting shall be at periodic intervals and in a format to be decided by the Conference of the Parties at its first meeting.

#### **Article 16; Effectiveness evaluation.**

1. Commencing four years after the date of entry into force of this Convention, and periodically thereafter at intervals to be decided by the Conference of the Parties, the Conference shall evaluate the effectiveness of this Convention.

2. In order to facilitate such evaluation, the Conference of the Parties shall, at its first meeting, initiate the establishment of arrangements to provide itself with comparable monitoring data on the presence of the chemicals listed in Annexes A, B and C as well as their regional and global environmental transport.

## **1.5 PURPOSE AND STRUCTURE OF NIP**

Like other Parties to the convention, Botswana is obliged to prepare a national Implementation Plan (NIP) to guide the implementation process and inform the government and its partners of the national priorities for action at determined times as per the action plans. This process/concept also fits well within the national development process of Botswana as is defined in the country's National Development Plan (NDP), District Development Plans (DDPs) and Urban Development Plans (UDPs).

The NIP development was financially supported by the Global Environment Facility, while the initial technical expertise within the country was created by the assistance of the United Nations Industrial Development Organization through an enabling activities project.

## **1.6 THE COMPONENTS OF THE NIP ARE:**

### **Inventories**

The process of inventorying POPs in Botswana started in 2004. This involved the establishment of a multi disciplinary stakeholder committee consisting different Government departments to steer the implementation of the Convention. This committee was also tasked with guiding the inventorying process undertaken by the Task Teams from four (4) thematic areas of:

- Pesticides and Contaminated Sites
- Legal, Institutional and Technical capacity
- PCBs, Dioxins, Furans
- Education and Awareness Raising

### **Action Plan**

Action plans of the NIP provides information to the relevant institutions on what actions need to be undertaken in dealing with POPs related issues. These measures are built on the country baseline, established by the inventories.

### **Endorsement**

The NIP development culminated in the endorsement of this document by the Government of Botswana.

## 2 COUNTRY BASELINE

### 2.1 COUNTRY PROFILE

#### 2.1.1 Geography and population

##### 2.1.1.1 Geography

Botswana is a landlocked country located in Southern Africa (Figure 1), north of South Africa, at the co-ordinates 22°S 24°E / -22, 24Coordinates: 22°S 24°E / -22, 24. Botswana occupies an area of 600,370 square kilometres, of which 585,000 km<sup>2</sup> are land. Botswana has land boundaries of combined length 4,013 kilometres, of which the constituent boundaries are shared with Namibia, for 1,360 km; South Africa 1,840 km; Zimbabwe, 813 km and Zambia, 2 km.



Figure 1: Map of Botswana

The land is predominantly flat to gently rolling tableland, although there are some slight mountainous areas, where mining is done. The Kalahari Desert is in the southwest. The Okavango Delta, the world's largest inland delta, is in the

northwest and the Makgadikgadi Pan, a large salt pan lies in the north. The lowest point is at the junction of the Limpopo and Shashe Rivers, at a height of 513 m. The highest point is in the Tsodilo Hills, at 1,489 m.

The annual climate ranges from months of dry temperate weather during winter to days or weeks of sub-tropical humidity interspersed with drier hot weather during summer. In summer (which lasts from October to March) temperatures rise to above 34 °C in the extreme north and south-west. In winter (which lasts from April to September), there is frequent frost at night and temperatures may fall below 2 °C during the day, but skies are usually cloudless and sunny. Summer is heralded by a windy season, carrying dust from the Kalahari, from about late August to early October.

Annual rainfall, brought by winds from the Indian Ocean, averages 460 mm including a range from 640 mm in the extreme north-east to less than 130 mm in the extreme south-west. The rains are almost entirely limited to summer downpours between December and April, which also mark the season for plowing and planting. Cyclical droughts, lasting up to five or six years in every two decades, can limit or eliminate harvests and reduce livestock to starvation.

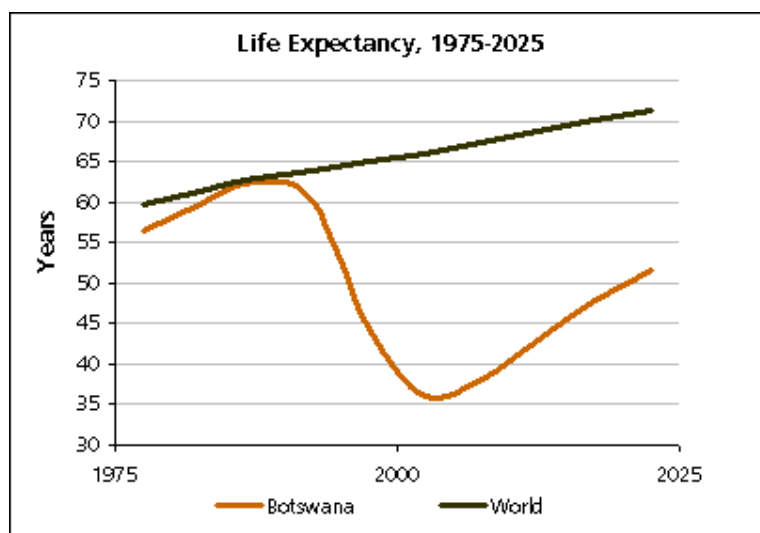
##### 2.1.1.2 Population

The population of Botswana in 2003 was estimated by the United Nations at 1,785,000, which placed it as number 144 in population among the 193 nations of the world. In that year

approximately 4% of the population was over 65 years of age, with another 41% of the population under 15 years of age. There were 96 males for every 100 females in the country in 2003. According to the United Nations (UN), the annual population growth rate for 2000–2005 is 0.85%, with the projected population for the year 2015 at 1,712,000. The population density in 2002 was 3 per square km. Nearly 80% of the population lives on the better soils of the eastern strip of the country.

It was estimated by the Population Reference Bureau that 50% of the population lived in urban areas in 2001. The capital city, Gaborone, had a population of 254,000 in that year. Other cities and their populations are Mahalapye, 104,450; Serowe, 95,041; Tutume, 86,405; Bobonong, 55,060; Francistown, 52,725; Selebi-Phikwe, 49,542; Boteti, 32,711; and Lobatse, 26,841. According to the United Nations, the urban population growth rate for 2000–2005 was 2.2%.

The prevalence of AIDS/HIV has had a significant impact on the population of Botswana. The United Nations estimated that 38.5% of adults between the ages of 15–49 were living with HIV/AIDS in 2001. The AIDS epidemic causes higher death and infant mortality rates, and lowers life expectancy (Figure 2)<sup>1</sup>. The population by age is elaborated in Figure 3.



**Figure 2: Life Expectancy in Botswana**

The main demographic indicators are elaborated in Table 1 .

**(a) Demographic Indicators (2007 estimate<sup>2</sup>)**

The main demographic indicators are elaborated in Table 1.

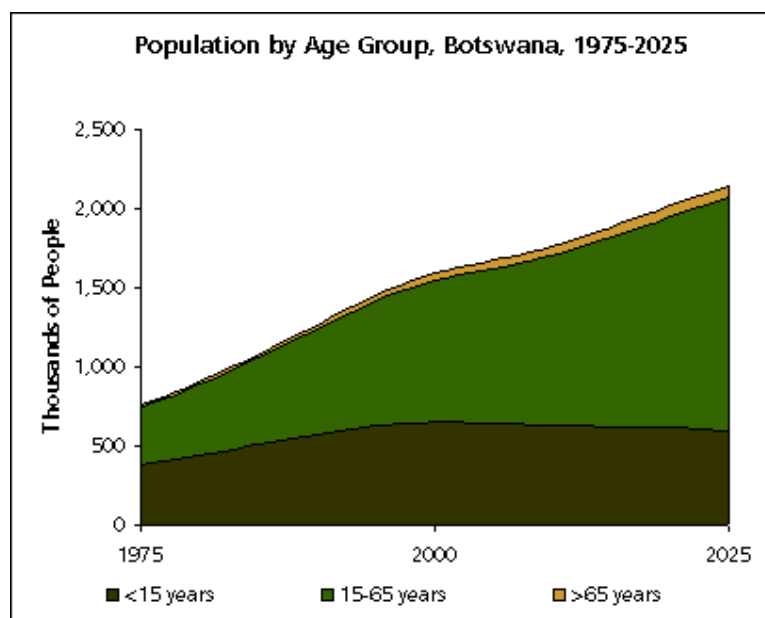
**Table 1: Demographic indicators for 2007**

Population:	1,815,508
Population growth rate:	1.503%
Population	0-14 years: 35.8% (male 330,377/female 319,376)

<sup>1</sup> <http://earthtrends.wri.org/text/population-health/country-profile-25.html>

<sup>2</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/bc.html>

Population:	1,815,508
distribution	<i>15-64 years: 60.3% (male 549,879/female 545,148)</i> <i>65 years and over: 3.9% (male 28,725/female 42,003)</i>



**Figure 3: Population by age group**

## 2.1.2 Political and economic profile

Botswana is noted for its sustained growth process ever since its independence in 1966. By commendable growth and prudent fiscal management, the economy has achieved macro economic stability and foreign exchange reserves. As a result, Botswana has elevated its status from that of a poor country to that of a middle-income country. Thus, it has been a tale of impressive growth performance for Botswana. The economy grew at an annual rate of 13 per cent during 1966 and 1991, which declined to 5 per cent thereafter till 2002.<sup>3</sup> Gross Domestic Product (GDP) per capita at current prices was P31, 937.0 in 2005/06.<sup>4</sup> Its per capita income was US \$ 5, 846 in 2005<sup>5</sup> (United Nations Development Programme (UNDP), 2007; p. 279).

When it got its independence, the per capita gross domestic product was just P1682.5 (at 1993/94 prices).<sup>6</sup> More than three quarters of the population lived in rural areas deriving its livelihood from agriculture (with low and uncertain levels of yield) and cattle farming. Opportunities for wage employment were quite limited; formal sector meant largely South African mines. Infrastructure was woefully inadequate in any sector of economic activity. Primary school attendance was quite limited; it was much less than 50 per cent.

The economy has undergone changes over time. Agriculture (livestock in particular) is no longer a dominant sector; it has yielded its place to the mining sector. Per capita GDP (at

<sup>3</sup> See <http://www.unbotswana.org/bw/undp/poverty.html>

<sup>4</sup> It was P13, 287.4 at constant 1993/94 prices (Government of Botswana (GoB), 2007).

<sup>5</sup> At the purchasing power parity (PPP) US\$ rate, it was 12, 387 in 2005 (UNDP, 2007; p. 279).

<sup>6</sup> See GoB, 2003b; p. 28

current prices) in 2005/06 for the country as a whole was P31, 937.0; it would be just P19, 540.6 if the mining sector were excluded (GoB, 2007). During the first decade of its independence, the economy depended largely on exports and its mainstay was beef. The discovery of minerals and diamond in the 1970s not only helped the country to outgrow its least-developed status but also led to changes in class relations, larger exposure to cycles in the global markets and favourable fiscal health of the government. The mining sector has contributed about a third of GDP, more than 70 per cent of export earnings and over 55 per cent of total government revenues during NDP 8 (1997/98 – 2002/03) (GoB, 2003b; p. 203).

### **2.1.3 Profiles of the Economic Sectors**

The content of this subchapter is based on the Budget speech (2008) Delivered to the National Assembly on 4th February, 2008 by Honourable Baledzi Gaolathe Minister of Finance and Development Planning<sup>7</sup>.

#### **2.1.3.1 Mining sector**

Botswana's minerals sector is flourishing. Exploration for a wide variety of minerals is active and several new mineral projects were launched during NDP 9. The headquarters of the Diamond Trading Company (Botswana) is at an advanced stage of construction, and will be fully functional during 2008. At the same time diamond cutting licenses have been issued to 16 companies and the expectation is that, by the end of 2008, a total of 3 000 people will be employed in the diamond manufacturing sector in Botswana. In addition, Messina Copper and DiamonEx (Botswana) have started mining operations, while African Diamonds has submitted an application for a mining licence for the AK 6 diamond deposit.

A tax agreement with the Botswana Metal Refinery (Activox) company was approved by this House in August 2007 as part of Government's efforts to promote beneficiation of minerals produced in the country. Under this project the copper and nickel ore will be processed to finished copper and nickel cathodes. The project is making steady progress, albeit, facing challenges common to similar projects worldwide, such as increasing construction costs, long lead times and shortage of skilled labour.

The diamond market has become more volatile in recent years. After a substantial increase in production to 34.4 million carats in 2006, Debswana's production is expected to have been lower in 2007, by about 761 000 carats, while other minerals' production showed significant growth in 2007. Gold production at the Mupane mine is expected to have increased from 2 546 kg in 2006 to 2 656 kg in 2007. Soda ash production for 2007 reached 279 625 tonnes from 255 677 tonnes in 2006. Similarly, salt production increased slightly from 151 595 tonnes in 2006 to 165 710 tonnes during 2007. Coal production at Morupule Colliery is expected to have declined from 962 427 tonnes in 2006 to 832 007 tonnes in 2007, mainly due to low customer off-take. In order to address this, a coal washing plant to improve the calorific value of the coal was constructed and commissioned in 2007. This will provide an opportunity to expand production and exports of coal to neighbouring countries.

#### **2.1.3.2 Agricultural sector**

The agricultural sector is the mainstay of the majority of rural households. Government makes investments in the sector with a view to improving its productivity, enhancing rural incomes and diversifying the economy, thus accelerating achievement of Vision 2016 through NDP 10. The Government has entered into an Agreement with a foreign private investor, to carry out a feasibility study of the Zambezi Integrated Agro-Commercial Development

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<sup>7</sup> Budget speech (2008) Delivered to the National Assembly on 4th February, 2008 by Honourable Baledzi Gaolathe Minister of Finance and Development Planning Website:<http://www.gov.bw>

Project in Pandamatenga. The private investor will invest in agro-commercial activities like fisheries, poultry, field crops, vegetables and oil plants; whilst Government investment will be in infrastructure, mainly for water conveyance from the Chobe-Zambezi River system to the project site for irrigation. The project will have a significant impact on the agricultural sector's contribution to GDP, agricultural exports, food security, economic diversification and employment.

The Arable Lands Development Programme and the Livestock Water Development Programme have been reviewed to enhance agricultural output in the communal agricultural sub-sector. However, these schemes are experiencing inadequate uptake, as a result of increased cost of components and some farmers being unable to raise the necessary down payment to access the schemes. Consequently, the guidelines of the schemes are being reviewed to help address these problems.

The report on the Agricultural Infrastructure Development Initiative produced in November 2004 indicated that only 17 percent of farmers have access to power, 22 percent to telecommunications, 45 percent to roads (i.e. primary, tertiary and all weather), and 64 percent to agricultural water. Given this situation, the report has identified these four main services as critical for increasing productivity in the agricultural sector. Therefore, Government is currently preparing a comprehensive strategy for the development of the agricultural infrastructure for implementation during NDP 10.

The country was plagued by a severe drought in 2006/2007 financial year due to deficient rainfall. As a result, both the total area planted and the yields were seriously affected. The total area planted during the 2006/2007 cropping season was 69 288 hectares, which was less than half of the 140 326 hectares planted during the 2005/2006 season. While the total cereal requirements for 2006/2007 exceeded 320 643 metric tonnes, total production for the commercial and communal sub-sectors was 33 431 metric tonnes, implying a substantial deficit for domestic consumption, which was met by imports.

Despite the drought condition, the food security situation remained stable, and child malnutrition of the under fives declined from 5.2 percent in 2006 to 4.1 percent in 2007.

### **2.1.3.3 Energy sector**

Reliable and efficient energy sources are a prerequisite for achieving the Vision 2016 Pillar of a Prosperous, Productive And Innovative Nation. In this regard, Government is working around the clock to ensure the successful implementation of the major energy projects. The Mmamabula Energy Project will produce 2,745 Megawatts (MW) electricity under the first phase of the project.

At the same time the development of the initial phase of the Morupule B Power Station Project, which entails the development of a new 600 MW gross capacity coal fired plant is at tender evaluation stage, with an Engineering Procurement and Construction award of the project scheduled for the end of March 2008.

Electrification is a fundamental conduit for development that will help us realize the aspirations of Vision 2016. At the beginning of NDP 9, 15 additional villages were electrified in addition to the 238 that had been electrified in the previous National Development Plans. Government has now embarked on a major programme of electrifying additional 130 villages and the extension of electrification network in 20 villages. Out of the 130 villages, it is expected that the electrification of 60 villages will be completed during the 2008, while the remaining villages will be completed during 2009 financial year.

About 75 percent of Botswana's electrical energy requirements are met through imports, mainly from South Africa. BPC is doing all it can to implement short, medium and long term power supply strategies to ensure that Botswana has sufficient power. BPC is introducing a wide range of measures to conserve electricity, including shifting load to off-peak periods.

#### **2.1.3.4 Transport sector**

Transport is a key platform for economic development, trade competitiveness, as well as domestic and regional integration. In addition to the upgrading of major airports, the construction of some of the major roads that is ongoing includes; the Tsabong-Middlepits, Middlepits-Bokspits, Dutlwe-Morwamosu and Sekoma-Kokotsha roads, whilst roads like, Francistown-Ramokgwebana, Francistown-Nata and Nata-Kazungula are under design and their construction will commence during 2008/2009. The dualling of the Gaborone-Tlokweng Border Post, Western Bypass- Metsimotlhabe, Tonota-Francistown and Gaborone-Boatle roads, will commence during 2008/2009. During the same year, new road projects like Charleshill-Ncojane, Tsabong- Hukuntsi and Molepolole-Lentsweletau, Boatle-Lobatse and the dualling of Mogoditshane- Gabane, will be designed for construction during NDP10.

#### **2.1.3.5 Information and Communications Technology sector**

Several information and communications technology initiatives are underway to accelerate achievement of the Vision 2016 Pillar of an educated and informed nation. To this end, a piece of land has been acquired near the Sir Seretse Khama International Airport for the construction of the Botswana Innovation Hub. The Hub will act as a catalyst to enhance Botswana's ability to compete globally in the information and communications technology arena. The project is expected to start in 2008 for completion in 2010.

### **2.1.4 Environmental Overview**

The country is divided into three main environmental regions. The hardveld region, where most population and economic activity concentrated, consists of rocky hill ranges and areas of shallow sand cover in south-eastern and east-central Botswana. (There is also a small area of hardveld in the extreme west, the Ghanzi ridge extending from the Namibia highlands.) The sandveld region is the area of deep Kalahari sand covering the rest of the country. A small number of out-cropping rocky hills extrude from the sandveld in the north and west. The third region of the country, consisting of ancient lake beds in the base of the Kalahari basin, is superimposed on the sandveld in north-western Botswana.

#### **2.1.4.1 Biodiversity**

Biodiversity is defined as the variability within and among living organism and the systems they inhabit<sup>8</sup>. Botswana's biodiversity is important for the sustainability of the country's livelihood especially in the rural areas. Other economic sectors like tourism also depend on biodiversity.

Generally, one of the threats to Botswana's biodiversity is habitat destruction and reduction emanating from the increase in population which leads to over-exploitation of the resources and/or factors related to development. Some of the factors that affect biodiversity include encroachment of human settlements into the virgin areas and therefore leading to habitat destruction. Habitat destruction and degradation also occurs through infrastructure

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<sup>8</sup> Ministry of Environment, Wildlife and Tourism (2005). Botswana Biodiversity Strategy and Action Plan -Revised 2007

development (construction roads, houses etc), pollution, unsustainable land and resource use that encompasses unsustainable range management, over harvesting of the resources and overgrazing that leads to bush encroachment. Biodiversity in Botswana is also affected by natural phenomenon such as climate change and evolution.

It is however, important to note that Botswana's biodiversity represents a huge asset both economically, ecologically. This is substantiated by the fact that the country has some of the unique ecosystems and endemic species that do not occur elsewhere in the world. In an effort to protect and conserve its biodiversity, Botswana has ratified the United Nations Convention on Biodiversity and as a way of implementing and adhering to the convention's obligations has developed a Biodiversity Strategy and Action Plan.

#### **2.1.4.2 Land degradation**

Rangeland is land that supplies forage or vegetation (grasses, grass-like plants and shrubs) for grazing (grass eating) and browsing (shrub-eating) animals. Rangeland may not be intensely managed. In Botswana there two types of rangelands: communal grazing areas and commercial ranches. Rangeland consists of grasses, wood plants, root plants (legumes) as well as bare ground. The degradation of rangeland is associated with the loss of fruitful capacity of the rangeland<sup>9</sup>.

As described in the National Conservation Strategy (NCS) 1990, degradation of rangeland pasture resources is due to a variety of management and other factors that are difficult to quantify<sup>10</sup>. However two facts generally recognized are: a significant proportion of the national range is undergoing degradation and; such degradation cannot be ascribed solely to drought.

According to State of the Environment Report 2002<sup>11</sup>, components of rangeland degradation include:

- Soil erosion;
- Change in soil structure;
- Decreases in palatable and nutritious plant species;
- Decreases in perennial grasses, and increases in annuals;
- Shrub encroachment;
- Decline in the quality and quantity of the forage;
- Decline in primary and secondary productivity of the rangeland; and
- Decline in the welfare of the herd-owners

The causes to range land degradation are mainly due to:

- Poor management practices;
- Frequent veldt fires;
- Recurring droughts;
- Poor enforcement of legislation; and
- Inadequacy of appropriate policy or legislation.

Information from studies carried out in Botswana<sup>12</sup> indicates that 17% of the rangelands of Botswana are degraded. This degradation is mainly attributed to depletion of palatable grass species and in some cases severe soil erosion due to poor vegetation cover. The State of the Environment Report (SOER) of 2002 identified roughly one sixth (1/6) of the total country's area as degraded. The report identifies three classes of degradation (which total the one-sixth)

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<sup>9</sup> Ministry of Environment, Wildlife and Tourism (2006). Botswana National Action Programme to Combat Desertification - 2006

<sup>10</sup> Ministry of Environment Wildlife and Tourism (1990). National Conservation Strategy (NCS) 1990

<sup>11</sup> Ministry of Environment Wildlife and Tourism (2002). State of the Environment Report (SOER)

<sup>12</sup> Ministry of Agriculture (1998). Botswana Rangeland Inventory and Monitoring Project Report

being; bare soil degraded areas (28 592 km squared), partially degraded areas (35 159 km squared) and bush encroachment areas (37 141 km squared).

Responses to rangeland degradation include:

- Public awareness and education to farmers on proper management of resources;
- Strong extension service to reach out to remote areas;
- Non conflicting policies that promote sustainable use;
- Even distribution of water sources for animals; and
- Promotion of sustainable agriculture

#### **2.1.4.3 Environmental Pollution**

Environmental pollution is a common problem in developing countries and Botswana is not an exception to this. The most pronounced environmental pollution is air and water pollution. Air pollution is the presence of one or more chemicals in the atmosphere in sufficient quantities and duration to cause harm to humans, other forms of life, and materials. Water pollution on the other hand is any chemical, biological, or physical change in water quality that has a harmful effect on living organisms or makes water unsuitable for desired use (Miller, 2002). Localized air pollution occurs from all mining activities especially around BCL mine and Morupule operations, as well as in some industrial areas, waste and mine dumps. Surface and ground water pollution through effluent discharge, hazardous chemicals' disposal and nitrates (human waste) are on the increase. As well, underground water is a prime source of water for drinking and for other purposes. On the other hand, ground water in aquifers is easy to deplete and pollute because much of it is renewed very slowly. Underground water pollution comes from numerous sources such as septic tanks, landfills, hazardous waste dumps, and deep injection wells for gasoline, cemeteries, oil and solvents.

Air and water pollution is mainly due to:

- Indiscriminate disposal of waste;
- Poor siting of potential polluting activities (Seepage from cemeteries, pit latrines and landfills);
- Industrialisation (power generating plants, mines, vehicles and industries);
- Agricultural activities- leaching of insecticides into the underground water system;
- Poor enforcement of legislature; and
- Low air quality standards.

Responses to water and air pollution include:

- Public education;
- Reuse and recycling of waste water;
- Appropriate policies, legislation and their implementation;
- New technology development;
- Enactment of Environmental Impact Assessment (EIA) Act in 2005;
- Maintenance of protected areas such as national parks, game reserves;
- Ratification of the Stockholm Convention and Montreal Protocol

#### **2.1.4.4 Other Environmental Problems in the Country**

Almost all environmental problems in the country are interrelated and are results (or are a manifest) of development and livelihood improvements. Botswana is endowed with a wide range of natural resources: wildlife, fresh air, clean waters, vegetation, soils, range and arable land, variety of minerals, as well as human, cultural and visual features<sup>13</sup>. The country has

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<sup>13</sup> Ministry of Environment, Wildlife and Tourism. Environmental Issues in Botswana (DEA Information Booklets 1-6)

taken an advantage of these existing resources by harnessing them to improve the lives of its people, hence mines, industries, dams, to name but a few. Although this has brought about improvement in the lives of Botswana, these resources have depleted over time due to the fact that some are finite, and some though renewable are not given enough time to regenerate due to overexploitation. Industrialization has also resulted in some undesirable negative effects (like pollution) on the environment as mentioned earlier.

Other environmental problems experienced by the country include;

- Depletion of natural resources such as water, wood and wildlife resources;
- Over exploitation of veldt products;
- Over exploitation of sand especially around the urban centres due high demand from the construction industry; and
- Land degradation.

## 2.2 INSTITUTIONAL POLICY AND REGULATORY FRAMEWORK

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

#### 2.2.1.1 Introduction

The natural resource base in Botswana, like elsewhere in the world, is an integrated functional system. Its utilization, administration and management is organized along separate but interrelated development and conservation processes, for administrative expediency. Most government ministries have responsibility for certain aspects of conservation alongside a number of statutory and non-statutory instruments that administer, manage and control some aspects of natural resources, and their products and services. While this sectoral approach to the management of the environment cannot be avoided. It is noted that a more integrated approach is desirable. Prior to the approval of the NCS in 1990, no policy mechanism existed which established an organization that could coordinate, supervise, superintend and oversee the discharge of environmental obligations by the various actors.

#### 2.2.1.2 General decision making process

##### Overview of the Form of Government

The Constitution of Botswana provides for a Republican form of government headed by the President with three main administrative organs, namely: the Executive, Legislature, and the Judiciary. Each of these organs is independent from the other organs. The principle of separation of powers is respected. The Executive comprises the Cabinet, headed by the President and it is responsible for initiating and directing national policies (Figure 4).

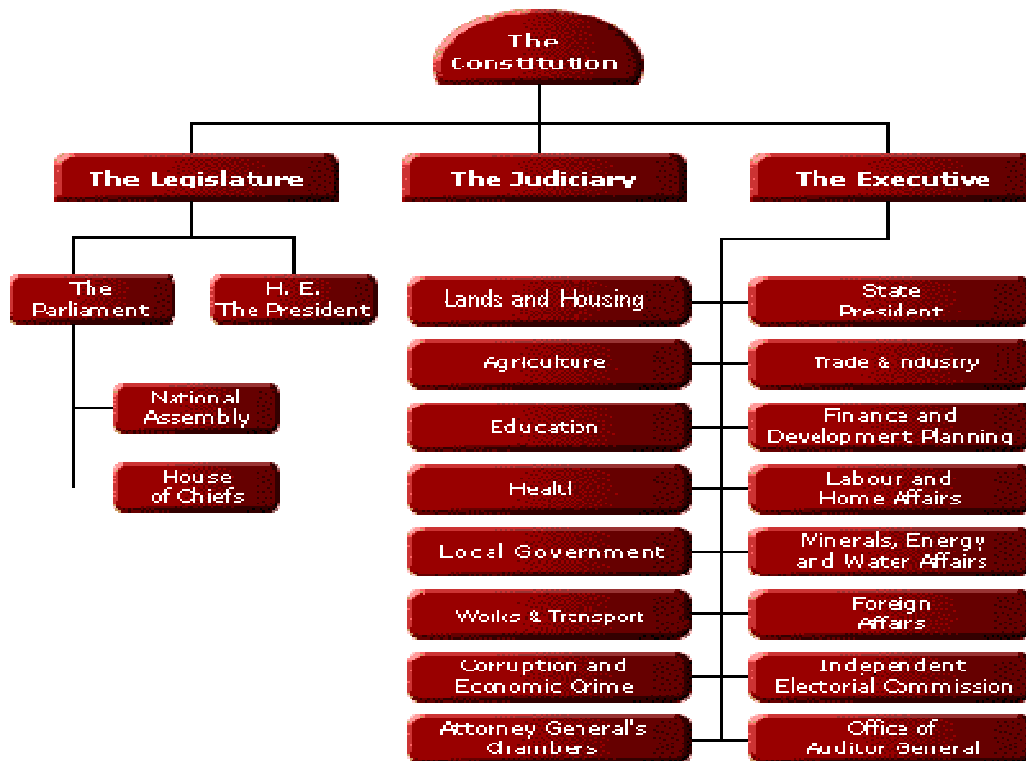


Figure 4.: General Structure of the National Government

The Legislature consists of the President and the National Assembly. Section 58 of the Constitution provides that the National Assembly shall consist of 57 (fifty seven) elected members, who shall be elected in accordance with the provisions of this Constitution, 4 Specially Elected members, the Attorney General and the Speaker of the National Assembly. The National Assembly, which is the supreme law-making authority in the country, acts in consultation with the 15-member *Ntlo ya Dikgosi* (House of Chiefs) on tribal matters. *Ntlo ya Dikgosi* is an institution of ex-officio and elected traditional leaders who represent tribal territories and administrative districts in the said *Ntlo* (House).

The Judiciary consists of the Court of Appeal, High Court, and Magistrates' Courts. Judges are appointed by the President with the advice of the Judicial Service Commission. The Judicial Service Commission comprises the Chief Justice; President of the Court of Appeal; the Attorney General; Chairperson of the Public Service Commission; a member of the Law Society, nominated by the Society; and a person of integrity and experience, not being a legal practitioner, nominated by the President. There is also the Industrial Court whose Judges are appointed by the President in terms of the Trade Disputes Act.

There are fourteen (14) government Ministries each headed by a Cabinet Minister which, together with the Attorney General's Chambers, Auditor General's office, and the Independent Electoral Commission, constitute the central government. For administrative purposes, each Ministry is sub-divided into Departments and Divisions with different areas of responsibility. The Ministry of Environment, Wildlife and Tourism, whose responsibility is managing environmental issues is a fairly new development. Issues relating to environment were dealt with the now Department of Environmental Affairs (former National Conservation Strategy Coordinating Agency, NCSCA), which was a division under various ministries, including Local Government and Lands and Housing. This means that the Agency lacked enforcement powers.

The country is divided into sixteen (16) administrative districts, each with its own District Council. These councils fall under the Ministry of Local Government and are responsible for among others, village water supply and public health, including waste management. On the other hand, central government ministries have decentralized some of their functions to administrative districts, e.g. Water Affairs, Immigration and Citizenship, Agriculture, Civil Registration, Labour and Social Security. In these districts, there is office of the District Commissioner, whose main role is to coordinate all district development activities.

### **2.2.1.3 Guiding philosophies and principles**

There are several principles which are now firmly embedded, if not established, in environmental law. Some of these principles have developed from the general practice of States and are regarded as constituting customary international law. This, legally speaking, means that States are bound to observe these principles. In addition there are those legal principles which have emerged from the national and international instruments discussed above. These guiding principles underlie the general fabric (rubric) of environmental law, and some have been incorporated in Botswana's environmental laws and policies.

### **Vision 2016 for Botswana**

Botswana finds itself in a period of history when social attitudes and values around the world are changing at unprecedented rate. This has been accelerated by the pace of urbanisation, and contact with diverse foreign cultures. As thus Botswana realised the need to establish a guiding principle, the vision, which guides strategic thinking and policy making in the coming

years, while helping to take stock of Botswana's past aspirations and the extent to which they have been realised. Under one of the visions' pillars: *a Prosperous, Productive and Innovative Nation*, Botswana commits herself, to take stringent measures to limit the pollution that would otherwise have resulted from rapid industrialisation, that Botswana will take pride in their clean and safe surroundings.

### **Sustainable Development**

This principle requires that human development and use of natural resources must take place in a sustainable manner. The 1987 Brundtland Report on the World Commission on Environment and Development, a precursor to the 1992 UNCED in Rio de Janeiro, defined "sustainable development" as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable development encompasses at least four mutually inclusive principles: firstly, the conservation of natural resources for the benefit of future generations (hereafter the principle of inter-generational equity); secondly, the exploitation of natural resources in a manner which is "sustainable" or "prudent" (hereafter the principle of sustainable use, and thirdly, the "equitable" use of natural resources. This element implies that the use by one State must take account of the needs of other States (hereafter the principle of equitable use). Fourth, the integration of environmental considerations into economic and other development plans, programmes and projects (hereafter the principle of integration of environment and development needs).

This principle is the most important general principle of environmental law. In a broader sense, it encompasses not only the legal, but also the economic and political fields. In fact, most of the principles on environmental law serve it.

### **Preventive Principle**

The preventive principle, which is firmly rooted both in international and national law requires that the activity, which does or will cause environmental pollution or damage is to be prohibited. It seeks to minimise environmental damage by requiring that action be taken at an early stage of the process. The effect of this principle is to constrain States against allowing polluting or harmful activities within their own national jurisdictions.

### **Precautionary Principle**

The precautionary principle has quite recently had an immense impact on the development of environmental law. This principle requires any proposed activity to ensure that it would not cause pollution before it is allowed to commence. The EC's first Action Programme best formulates the basis of principle thus: "the best environmental policy consists in preventing the creation of pollution and nuisance at source, rather than subsequently trying to counteract their effects." The principle is used to justify protective environmental measures before a specific environmental hazard has been identified and to place the onus of proof that environmental damage would not occur upon the polluter. Therefore, environmental damage should, as a priority, be rectified at source.

### **Polluter Pays Principle**

According to this principle, the costs of environmental pollution should be borne by those whose activities were responsible for causing the pollution. This principle applies both at general and specific levels. At the specific level, the principle requires that identified polluters should pay the full costs of the rectification of any environmental degradation that has occurred as a result of their activities. Used at this level, the principle is manifested in the rules governing civil and state liability for environmental damage due to hazardous activities. At a general level, the polluter pays principle acts in such a way that all human economic activity which impinges upon the environment should be fully accounted for in the economic pricing system of goods and services produced by such activity. This sense of the principle is much more far-reaching in its impact on people's daily lives than the mere provision of full compensation for environmental damage as a result of defined polluting activities.

### **The Principle of Public or Citizen Participation**

The underlying assumption of this principle is that in order to have effective implementation of environmental laws at all levels, individuals should be able to participate in environmental decision-making. This participation is two fold. One in which participation may amount to a little more than procedural rights such as the rights to seek information, to be consulted before decisions are taken and to gain access to the courts to challenge the decision after they have been taken. The other is whereby, citizen or public participation extends beyond procedural matters and demands nothing short of legally enforceable environmental rights. Citizens should be accorded more substantive rights in decision-making.

### **The Principle of Integration**

This principle basically requires that environmental protection must be integrated, interwoven within policies such as agriculture, tourism, industry etc. There should be a holistic approach to environmental protection with regard to land, air and water.

### **User Pays Principle**

According to this principle, the costs of environmental pollution should be borne not only by those whose activities were responsible for causing pollution but also by users of any activities and programmes which adversely affect the quality of the environment.

#### **2.2.1.4 Environmental Policy and Legislative Overview**

It is worth noting that the Bill of Rights in the Constitution of Botswana does not enshrine environmental rights as some of the rights to which individuals are entitled. In fact, most Independence Constitutions of the 1960's are silent not only on environmental rights but also generally on what in human rights lexicon are called third generation rights. These rights entail the right to development, peace and the right to a clean environment (environmental rights). This is in stark contrast with newly adopted constitutions in other jurisdictions such as the 1996 Constitution of South Africa and Constitution of Namibia, 1990. Both these Constitutions firmly entrench environmental rights.

In order to reflect the emerging trend of entrenching environmental rights in national Constitutions, any proposed environmental legislation should not only protect these rights but should also correspondingly impose legal duties on other individuals and institutions alike to

respect the individuals' rights. The up-coming Environmental Management Bill provides for access to safe and clean environment be a right. But, one major problem here relates to the enforcement of these rights. As with most human rights falling under the third generation of rights, environmental rights are not easily enforceable through the usual judicial process, say, like the right to liberty or due process.

### **Agrochemicals Act. of 1999**

The Agrochemicals Act, 1999, provides for the registration and licensing of Agrochemicals; to control or regulate their importation, manufacture, distribution, use and disposal, so as to prevent pollution to the environment or harm to human, plant or animal life. According to this Act, the term Agrochemical means any organic, inorganic or live biological material intended or offered for sale for the purposes of:

- a) destruction, control, repulsion, attraction or prevention of any undesirable life forms injurious to plant and animal growth; or
- b) promotion or inhibition of plant growth such as fertilizers, growth regulators, hormones, defoliant or legume inoculants.

According to the definition of an Agrochemical in this Act, any pesticide that is a public health pesticide such as DDT or an industrial pesticide such as Chlordane cannot be regulated using provisions of this Act. The Act regulates only pesticides that are meant for agricultural purposes.

The Act would only be able to regulate the industrial and public health pesticides if the definition of an Agrochemical in Section 2 of the Agrochemicals Act is amended to include them. In this way, all chemicals listed in Annex A and C would not be registered for use in Botswana without necessarily having to ban them. Chemicals such as DDT would also not be registered for use in Botswana but when there is need for its consumption then the concerned Ministry would have to request for an exemption from the secretariat of the Stockholm Convention as well as from the registrar of Agrochemicals in Botswana.

The Act has other provisions on the safe handling of pesticides such as the use of proper protective clothing, medical examinations for employees handling agrochemicals, storage and disposal of pesticides waste; hence the same would apply in regulating the handling of public health and industrial pesticides.

### **Public Health Act (draft)**

The Public Health Act is currently being repealed to accommodate the provisions for current challenges that have Health and Environmental impacts. The Act only makes general provision in as far as chemical hazards are concerned and therefore it is not specific to POPs. This could be intentional for the Act because during the consultative process it was realised that the department that is repealing the Public Health Act was simultaneously developing the Chemicals Safety and Products Act. Also other government Ministries such as Ministry of Agriculture were having something in place for the regulation of chemicals. Since the purpose and the intent of the Act is to regulate all hazards, risks and nuisances that could be detrimental to the health of Botswana Public it makes very general provisions and its being enacted as an overarching Act in as far as Public Health is concerned. Where provisions that relate to the health of the public are contravened and the other Acts that have related intent and purpose the provisions in the Public Health Act will supersede all other Acts.

### **Waste Management Act of 1998**

The Waste Management Act of 1998 does not address the provisions of the Stockholm Convention on elimination, prohibition, production and use of Annex A and B POPs

chemicals and reduction of unintentional releases of Annex C POPs chemicals. However, it does touch on the provisions of the Basel Convention with regard to regulation and control on trans-boundary movement of hazardous waste. It gives the Minister powers where necessary to give a directive under Section 45(3) of the Act to ensure compliance with the requirements of the Basel Convention.

## **2.2.2 Roles and Responsibilities of Ministries, Agencies and other governmental institutions involved in POPs life cycles**

### **2.2.2.1 Institutional Framework**

#### **i) Ministry of Environment, Wildlife and Tourism**

##### **a) Department of Environmental Affairs**

In recognition of the need for sustainable development, the government of Botswana established the National Conservation Strategy (NCS) (Government Paper No. 1 of 1990). Under the auspices of the NCS, the Advisory Board and the NCS Coordinating Agency were established under the then Ministry of Local Government, Lands and Housing. The Agency services the board by coordinating the execution of its decisions and liaising with government ministries, local authorities, parastatals, and private non-governmental, commercial and industrial organisations to ensure that the NCS goals and objectives are achieved. The primary goals of the NCS are to; increase the effectiveness with which natural resources are used and managed, so that beneficial interactions are optimised and harmful environmental side effects are minimised; Integrate the works of sectoral ministries and interest groups throughout Botswana, thereby improving the development of natural resources, and vice versa.

Achievement of the foregoing requires a comprehensive evaluation of the economic, social and environmental implications prior to major new developments being undertaken, to foster sustainable development. The most notable functions of the NCSA are that of coordination of environmental policy formulation and implementation. This function has been frustrated by the lack of an overarching legislation and its status as a line department, which implies lack of autonomy. Studies have however been commissioned to provide insights into the constraints and limitations that the institutions faced. The NCS task Force (1994) and the NCS Action Plan (1998) recommended an overarching legislation be promulgated to give both the NCSA and the NCS Board the legal backing that will empower them to undertake their functions effectively. In addition, the NCS Task Force and the Organizational Methods report recommended that the institutions should be parastatals. These recommendations are yet to be implemented.

The NCS identified several major environmental issues that needed to be addressed. These include:

- Pressure on water resources
- Degradation of rangeland and pasture resources
- Depletion of wood resources
- Exploitation of veld products
- Pollution
- Resource pressure due to growth in human population
- Depletion of and conservation of wildlife resources
- The need to improve environmental awareness

## **b) Department of Waste Management and Pollution Control**

The Department of Waste Management and Pollution Control makes provision for the planning, facilitation, implementation of systems for regulating the management of controlled waste in order to prevent harm to human health, animal and plant life; to minimise pollution of the environment, to conserve natural resources; and to facilitate the implementation of the provisions of the Basel Convention to regulate the transboundary movement of hazardous wastes and their disposal.

## **c) Department of Meteorological Services**

- Formulating, implementing and monitoring policies and strategies in meteorology relating to instrumentation, observations, data collection, processing and dissemination;
- Developing and providing effective weather forecasting and climatological services in order to meet national meteorological imperatives;
- Providing an effective operational meteorological services;
- Undertaking research and provide climatic information to contribute to socio-economic development;
- Procuring, installing and maintaining meteorological and telecommunications equipment for weather observations and communications.

## **ii) Ministry of Agriculture**

### **a) Division of Plant Protection (DPP)**

The DPP was established in 1987. It is mandated to spearhead the control/management of crop pests and diseases. The division ensures environmental sustainability through application of environmental friendly devices such as integrated pest management.

### **b) Department of Animal Health and Production**

The Department of Animal Health and Production is one of the biggest in the Ministry of Agriculture comprising five Divisions, Veterinary Field Services; Tsetse and Trypanosomiasis Control, Meat Hygiene and Quality Control; National Veterinary Laboratory; and Animal Production. The overall objective of this Department is to control nationally and economically important animal diseases, such as Foot and Mouth disease and Anthrax, as well as prevent and control disease outbreak through strict adherence of high standard of animal health, as well as improving sustainable livestock production and management practices.

## **iii) Ministry of Education**

### **a) Department of Secondary Education**

The main responsibility of the Department is to plan, formulate programmes, implement, monitor and evaluate the National Secondary Education System. The Department also prepares budget for the entire secondary education system and monitors the use of funds by schools and regional offices. The Department has decentralized some of its functions to six Regions.

## **iv) Ministry of Finance and Development Planning**

**a) Botswana Unified Revenue Service (BURS) (Formerly Department of Customs and Excise)**

The BURS is responsible for implementing the Customs and Excise Act, which regulates import of goods for customs duty and value added tax purposes.

**b) Central Statistics Office**

The Central Statistics Office (CSO) is a government Department in the Ministry of Finance and Development Planning. It is the apex body in the official statistical system of the country; hence most official statistical operations fall within the mandate of this office. More specifically, the aims of the Central Statistics Office may be outlined as follows:

- To act as the nodal agency for planned development of the statistical system in the country.
- To lay down and maintain the norms and standards in the field of statistics, involving concepts and definitions, methodology of data collection, processing of data and dissemination of results.
- To provide an advisory service to Government and other users on all-statistical matters and related subjects.
- To provide regular and timely statistical information on the economic and social state of the country and its people.
- To provide statistical information on the socio-economic status of households and families in Botswana.
- To provide information on the population characteristics from time to time.
- To conduct the large scale all-Botswana sample surveys for creating data base needed for studying the impact of specific problems for the benefit of different population groups in diverse socio-economic areas such as employment, consumer expenditure, literacy levels, health, informal sector activity etc.
- To provide an in-house facility to process the data.
- To conduct and arrange the training programmes in statistics and related subjects.
- Dissemination of statistical information on various aspects through a number of regular or ad-hoc publications to Government, parastatals, SADC member countries and various other national and international organisations; and through seminars/workshops.
- To ensure that the work programme for the office reflects the needs of users and to encourage frequent communication with users in order to assess these needs.
- To expand the scope for statistical services as and when resources permit.

Botswana Trade Statistics are compiled through the Trade Statistics Unit from customs declaration documents. Goods declared at ports of entry/exit are classified according to the Harmonised Commodity Description and Coding System of Botswana, which is an adapted version of the internationally recognised Harmonised Commodity Description and Coding System. This unit compiles and analyses trade statistics consisting of imports and exports (made of re-exports and domestic exports) data contained in the BURS documents, which are completed by exporters and importers or their agents.

## **v) Ministry of Health**

### **a) Environmental and Occupational Health Division**

The Environmental and Occupational Health Division is a new Division under the newly restructured Department of Public Health. Its main function is the development of legislation, policies and standards that have health and environmental relevance in collaboration with other government departments and the coordination of their implementation. The restructuring process took cognisance of the fact that some programs that are related to health and safety are not clearly articulated in the factories Act in that the Factories Act covers aspects in Factories only and not all other places. Since the other places where hazards and risks occur are covered by the Public Health Act. The Ministry therefore instituted the formation of a Division that also deals with Health and safety issues hence the name. The role of this Division is anticipated to be dealt with the development of the Chemicals Substances and Products bill.

### **b) Disease Control Division**

On the same Department there is Disease Control Division in which Entomology Unit falls under. The Unit is charged with the responsibility of control of all diseases that relates to vectors the main one being Malaria which is endemic in the northern region of the country. Though the unit is within the Public Health Department no provision specific to regulation of DDT is provided for in the Public Health Act; probably because Botswana has not been using the insecticide for a while. This may be the case with other Acts that regulate the use of insecticide. The Act that is being developed should cover the provisions of the Stockholm Convention by regulating the use of Annex B chemical, DDT.

## **vi) Ministry of Labour and Home Affairs**

### **a) Division of Safety and Health**

The Division of Occupational Health and Safety is based in the Ministry of Labour and Home Affairs. Its mandate is to enforce the Factories Act of 1973 whose main aim is to regulate the conditions of employment in factories and other places of work with regard to safety, health and welfare of persons employed. The Act covers all hazards that are found in the workplaces including a wide range of places of employment where chemicals are formulated, used and packaged for purpose of trade.

## **vii) Ministry of Minerals, Energy and Water Affairs**

### **a) Department of Water Affairs**

The overall objective of the Department of Water Affairs is to assess, plan, develop and maintain water resources for domestic, agricultural, commercial, industrial and other uses in the whole country. In order to provide effective leadership for water resources planning, development and management, the Department assists and advises in the formulation of water resources development and management policies. The Department assesses plans, develops and manages water resources for short, medium and long term purposes. It also administers the water law and other related legislations, and liaises with the riparian users of nation and international rivers on the saving, conservation and protection of water resource.

### **b) Department of Mines**

The overall objectives of the Department of Mines are to establish and maintain an effective organization to administer mineral exploitation legislation, and to enhance socio-economic, financial and other benefits to Botswana arising from the exploitation of mineral resources.

With respect to mineral policies, the Department assists in developing sound national policy on mineral development and operation. The Department also provides professional guidance on matters pertaining to mine safety and control of pollution arising from mining activities. The Department of Mines formulates and provide technical guidelines, performance standards for mining, mineral processing and metallurgical operations and advice government accordingly.

### **viii) Ministry of Trade and Industry**

#### **a) Department of Trade and Consumer Affairs; Consumer Protection Unit**

The Consumer Protection Division of the Department of Trade and Consumer Affairs is mandated to protect consumers against unfair business practices. The tool used is the Consumer Protection Act of 1998.

#### **Roles and Responsibilities**

The office has been mandated to carry out the following functions:

- Conduct research on consumer protection policies, laws and regulations and make recommendations on improvements required thereon.
- Disseminate information to enable consumers to acquire knowledge of basic consumer rights and obligations and the skills needed to make informed choices about goods and services.
- Formulate and implement consumer education programmes.
- Conduct comprehensive surveys on consumer behaviour, consumption patterns, market prices, size and quality of products, unfair business practices and any other related matter, and publish reports on the findings of the surveys.
- Collect and analyze information on harmful and unsafe products, publish reports on the findings and make recommendations on safety standards to the government.
- Receive and investigate complaints of unfair business practices.
- Search, seize and cause testing, where necessary, of products on the market to ensure that specifications, performance, quality and safety standards are met;
- Preside over disputes of unfair business practices with the objective of assisting the parties to the dispute to reach settlement.
- Assist a consumer or class of consumers to initiate civil or criminal proceedings arising from an unfair business practice.
- Do all such other things as may be necessary to protect consumers from purchasing or otherwise acquiring substandard goods or services or from being otherwise exploited.

#### **Non Governmental Organisations and Parastatals**

Relevant NGO activities are elaborated under chapter 2.3.9.

#### **Relevant Committees**

Currently there is no specific committee that deals directly with POPs except the National Coordinating Committee on POPs, which was not legally established.

### **2.2.3 Relevant international commitments and obligations**

The following table (Table 2) indicates the international treaties, conventions including international and regional agreements, to which Botswana is party. It also indicates the status of those international instruments, in terms of whether they have been signed, ratified or acceded to.

**Table 2: Relevant international treaties**

<b>International Treaty/Convention/Agreements</b>	<b>Signed</b>	<b>Ratified</b>	<b>Acceded to</b>
Stockholm Convention on Persistent Organic Pollutants			✓
The Basel Convention on the Control of Transboundary Movement of Hazardous Waste and the Disposal			✓
Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals			
Convention to Combat Desertification		✓	
The Convention on Wetlands of International Importance			✓
The United Nations Framework Convention on Climate Change		✓	
The Convention on International Trade in Endangered Species			✓
The Convention on the Protection of World Cultural and Natural Heritage			✓
The United Nations Convention on law of the Sea		✓	
Convention Against Illicit Trafficking in Narcotic Drugs and Psychotropic Substances	✓		
The Commission on Sustainable Development – Agenda 21			✓
Montreal Protocol on Substances that Deplete the Ozone Layer			✓
The Permanent Okavango River Basin			✓
The SADC Protocol on Shared Watercourses Systems	✓		

Botswana is also signatory to the Procedure for Certain Hazardous Chemicals ILO 170 and 174, on procedures in handling major accidents and chemical safety. Botswana has not ratified these and as such is not bound by them.

## 2.2.4 Description of existing legislation and regulations addressing POPs

There are several pieces of legislation that deals with management and enforcement of pollutants and chemicals in general. These however do not address POPs specifically. These are shown in the table below (Table 3).

**Table 3: Analysis of the current legislative framework**

Legislation/Issuing Ministry	Brief Description	Relation to Stockholm Convention	Gaps
Waste Management Act (Ministry of Environment Wildlife and Tourism)	Provides for the planning, facilitation, implementation of advanced systems for regulating the management of controlled waste in order to prevent harm to human, animal and plant life; to minimise pollution of the environment, to conserve natural resources; to cause the provisions of the Basel Convention to applying regulating the trans-boundary movement of hazardous wastes and their disposal; and for matters incidental to and connected to the foregoing.	The act; *Provides for safe handling of waste, including hazardous waste. *Provides for prevention of pollution, polluter pay principle, including civil liability and duty of care. The above relates to Article 6 of the convention	The regulations do not make provisions for POPs
Factories Act (Ministry of Labour and Home Affairs)	Makes provision for the regulation of the conditions of employment in factories and other places as regards safety, health and welfare of persons employed herein and provides for inspection of certain plant and machinery.	Safe guard human health, which relates to article 1 of the convention	Lack of regulation, which may cover chemical safety.
Atmospheric Pollution Act (Ministry of Environment, Wildlife and Tourism)	Provides for the prevention of pollution of the atmosphere by industrial processes.	Ensures that pollution are within acceptable limits to safeguard human health and environment, which relates to Article 1 and 5 of the convention	Limits for Annex C POPs are not established
Public Health Act (Ministry of Health)	Provides for risks, hazards and nuisances that are detrimental to the health of public	Provides for disposal of anything that maybe of danger to human health in a safe manner (Relates to Article 1 and 6 of the convention)	Provisions are general and not specific to POPs.
Waste Management Act (Ministry of Environment Wildlife and Tourism)	Provides for the planning, facilitation, implementation of advanced systems for regulating the management of controlled waste in order to prevent harm to human, animal and plant life; to minimise pollution of the environment, to conserve natural	The act; *Provides for safe handling of waste, including hazardous waste. *Provides for prevention of pollution, polluter pay principle, including civil liability and duty of care. The above relates to Article	The regulations do not make provisions for POPs

<b>Legislation/Issuing Ministry</b>	<b>Brief Description</b>	<b>Relation to Stockholm Convention</b>	<b>Gaps</b>
	resources; to cause the provisions of the Basel Convention to applying regulating the trans-boundary movement of hazardous wastes and their disposal; and for matters incidental to and connected to the foregoing.	6 of the convention	
Factories Act (Ministry of Labour and Home Affairs)	Makes provision for the regulation of the conditions of employment in factories and other places as regards safety, health and welfare of persons employed herein and provides for inspection of certain plant and machinery.	Safe guard human health, which relates to article 1 of the convention	Lack of regulation, which may cover chemical safety.
Atmospheric Pollution Act (Ministry of Environment, Wildlife and Tourism)	Provides for the prevention of pollution of the atmosphere by industrial processes.	Ensures that pollution are within acceptable limits to safeguard human health and environment, which relates to Article 1 and 5 of the convention	Limits for Annex C POPs are not established
Chemical Substances and Products Act (Ministry of Health)	An Act devoted to industrial chemicals, regulates environmental and human health proposes.	The act is currently being developed	The act is currently being developed

From the table it can be seen that most of the Acts, Policies and Strategies hardly address POPs objectives. This shows a glaring omission or gap on the part of the Policies and Acts. For Botswana to effectively implement the POPs Convention there is a need to revisit the policies and legislative instruments to take onboard issues of POPs.

## **2.2.5 Key approaches and procedures for POPs chemical and pesticide management including enforcement and monitoring requirements**

Information concerning this chapter is included in the previous chapters. It is also discussed as part of the inventories in chapter 2.3.

## **2.3 ASSESSMENT OF THE POPs ISSUE IN THE COUNTRY**

### **2.3.1 Assessment with respect to Annex A, part I chemicals (POPs pesticides)**

#### **2.3.1.1 Introduction**

Persistent Organic Pollutants (POPs) are chemical substances that are very stable hence persist for long periods if applied to the environment. They also have the ability to bio-accumulate, bio-magnify and therefore pose risk of causing adverse effects to human health and the environment. Due to the evidence of the long transportation of such substances, and the consequent threats they pose to the environment world wide, there is need for urgent global action to reduce their release into the environment.

The Agrochemicals Act of 1999 provides for the registration and licensing of agrochemicals to control their importation, manufacture, distribution, use and disposal so as to protect pollution to the environment or harm to human health, plant or animal life. DWMPC, whose act, the Waste Management Act of 1998, empowers them on issues of disposal, makes provision for ensuring safe disposal of the pesticide wastes.

The outcome of this inventory indicated that there are POPs pesticides in the country. The study further revealed other critical chemical management issues such as occupational safety and health risks, inappropriate labelling and inappropriate storage that need to be addressed. It became evident from the study that Botswana does not manufacture any chemicals but imports them from South Africa, India, Zimbabwe and other countries in Europe. Botswana has companies which only repackage these products and distribute them countrywide.

There are no dedicated storage facilities for chemicals in all entities inventoried. In some instances there were no dedicated storage facilities for the pesticides, and they were stored within human dwelling areas. Some empty containers were used as drinking water storages as well as storing other different chemicals. There is a major problem regarding the issue of disposal. Apart from Plant Protection Division stockpiling empty containers and obsolete pesticides from farmers in the warehouse other institutions do not have the right means of disposing the chemicals.

There was no indication that awareness of the POPs Convention was done amongst farmers, extension officers and district officers, therefore during the inventory a briefing was made to raise awareness on the POPs and the convention. The convention text, pamphlets and T-shirts were also distributed.

#### **2.3.1.2 Objectives and methodology**

The starting point for the establishment of National Implementation Plan (NIP) includes the inventory of POPs pesticides and contaminated sites, and development of the database thereof. At this stage the overall national situation regarding POPs is being documented. This documentation will input in the establishment of priorities and options that will guide the

formulation of specific strategies and actions that will be proposed and committed to in the actual NIP.

The purpose of the inventory was to establish the Botswana situation in relation to issue of POPs pesticides, contaminated sites, capacities in place to deal with them and also determine the level of knowledge. The focus of the inventory was farmers, industry and institutions.

The process of inventorying the POPs pesticides and contaminated sites was carried out by a task teams that included experts from Department of Mines, Crop Production, Public Health and Local authorities. This task team was developed during the training program for compiling POPs inventories for the Stockholm Convention.

### **2.3.1.3 Institutional and Regulatory Framework**

In Botswana the Agrochemicals Act of 1999 is an act to provide for the registration and licensing of agrochemicals. This is to ensure the control and regulation of their importation, manufacture, distribution, use and disposal so as to prevent pollution to the environment or harm of humans, plants, and animals. The limitations of this act are that it is only applicable on chemicals intended for agricultural use and excludes industrial and public health chemicals.

According to this act the requirements for importation, distribution, manufacture and use are that:

- i) The pesticide be registered with the registrar of agrochemicals.
- ii) The importer must be licensed to import.
- iii) In case the chemical is not registered or is unavailable in the local market the importer may apply for a temporary import permit (limited quantities and a single entry).

The Waste Management Act of 1998 provides for the implementation of advanced systems for regulating the management of controlled waste in order to prevent harm to humans, animals, and plants. This is intended to minimize pollution of the environment and to conserve natural resources. The short falls in this act is that it does not have regulations and as such is difficult to implement.

According to this act, the carrier waste needs to be registered with the Department of Waste Management and Pollution Control to be able to transport controlled waste within Botswana or across the country. Waste disposal sites and waste management facilities must be registered with the Department of Waste Management and Pollution Control to be allowed to handle controlled waste.

Botswana is signatory to the Basel Convention intended to address trans-boundary movement of hazardous chemicals. This convention is housed in the Department of Waste Management and Pollution Control and as such its implementation is provided for by the Waste Management Act of 1998.

The Stockholm Convention intended for the phasing out and ultimate elimination of POPs.

### **2.3.1.4 Past, Present and projected Production and use of POPs Pesticides**

The use of pesticides in the country in the past was limited to the control of pests in the health and agricultural sectors resulting in huge quantities of pesticides donated to the country for

pest control. Since the last disposal of 320 tonnes in 2002 of obsolete pesticides there is a decline in their accumulation. Currently, only 50 tonnes of empty containers have been collected in the past 5 years. It is projected that there will be further decline in the consumption and use of pesticides due to the control measures put in place by the Agrochemicals Act and the ratification of the Stockholm Convention by Botswana. However, the building and construction industry has been identified through the survey as the major user of the POPs pesticides.

There is no production of pesticides in the country hitherto; rather pesticides are imported in bulk and repackaged in the country. By virtue of the country being a gross importer of pesticides, it is assumed that there is no exportation of the pesticides from the country.

### **2.3.1.5 Identified Stockpiles of POPs Pesticides and POPs Pesticides Waste**

#### **i) Methodology**

The inventory was intended to assess POPs pesticides stocks and contaminated sites in the farming community, industries, and institutions. The survey was in two phases covering the farming community in the first phase, and industries and institutions in the second phase. For the first phase data collection was done through administration of three questionnaires, based on oral interviews. The first questionnaire was aimed at inventorying the pesticides and their quantities; the second one was inventorying the contaminated sites, while the third questionnaire gathered information on the state of knowledge on stockpiles. Collection of data started on the second week of October and lasted for a period of two weeks. In the second phase, data collection was done through the use of a questionnaire which was used for the collecting information on pesticide inventory. The questionnaire was not self administered instead demanded that the teams go out to meet with the clients. The questionnaire is here attached to the report. Collection of data started on the third week of February 2007 and lasted for a period of two weeks

#### **ii) First Phase**

Areas of interest for the first phase of the survey were agricultural lands and pesticide storages in the farms, areas where agricultural pest control activities are known to have taken place either for crop or animal protection (Quelea and Tsetse control sites) and also pesticides dealerships in the various villages and towns.

In recognition of the fact that nine of the twelve POPs are agricultural pesticides, this influenced the teams to concentrate more on prime agricultural places. There are six blocks that divide the country into agricultural regions. The levels of productions and activity are varying from region to region. Three of the most active regions were identified and consequently surveyed. The survey for the three regions being North West, Central and Southern was total coverage. The selection was not undermining the importance of other remaining three regions which are Gaborone, Francistown and Western regions. The task team members were divided into three groups of two members to cover the three regions.

#### **iii) Second Phase**

The second phase of the survey was confined to the following areas; Gaborone, Francistown, Lobatse and Selibe Phikwe. The criteria for selection of these areas was based on their proximity to various ports of entry into Botswana. These areas are also believed to be the centre of activity. This phase of the survey was carried out in institutions, school, industry,

government and non government departments. The task team members were divided into four groups of two members to cover the four areas.

#### **iv) Results and Discussions**

A total of 78 farms and 3 pesticide control areas were visited in the first phase of the inventory. Of this, no POPs pesticides were identified in the farming community nor any contaminated sites. During the second phase of the inventory where industries and institutions were visited, 78 litres POPs pesticides were identified and this was mainly in the four towns.

It cannot be concluded that there are no POPs pesticides in the country. It was observed that there is Ant poison in the shelves. The active ingredient of ant poison can be Chlorpyrifos 20%, Chlorpyrifos methyl or Chlordane. Most of the repackaging of Ant poison is done by companies in Botswana which include Clean Tech, Gaborone Chemicals, C&P Chemicals etc.

In one particular incident it was observed that a repackaging company had Chlorpyrifos as an active ingredient in the 5 litre containers of Ant poison but chlordane in some of the 1 litre containers. The team observed that there is a high probability of large consumptions of POPs pesticides especially in the treatment of soil for construction. That however can only be proved by obtaining samples from the industries and testing for the exact active ingredients.

It was also observed that the farming community had replaced the POPs pesticides with organophosphates, other organochlorines, carbamates and pyrethroids.

Labelling of the repackaged products does not comply with the standards recommended by the WHO hazard classification. There were also no warning signs in places where these hazardous products are used, stored or sold to alert the public.

#### **2.3.1.6 Present Management of Storage, Disposal of Obsolete Pesticide and Empty Container**

Storage of pesticides and their empty containers is vital due to the dangers associated with them. Improper storage can result in accidents such as explosions, fires and contamination. There is a problem of storage for pesticides in all entities visited i.e farms, industries and institutions. In some instances there were no dedicated storage facilities for the pesticides, and they were stored within human dwelling areas. For example, Pesticide storage rooms in most of the schools are inside the classrooms and these rooms are normally not well ventilated hence creating odours that can be smelled from the classroom. In some farms pesticides are stored in bedrooms and kitchens. Reuse of empty containers is a common practice among farmers. Some empty containers were used as drinking water storages as well as storing other different chemicals from the one originally occupying the container.

There is a major problem regarding the issue of disposal of empty containers and absolute pesticides. Apart from Plant Protection Division stockpiling empty containers and obsolete pesticides from farmers into the warehouse. Other institutions do not have the right means of disposing the chemicals. The town councils do not provide services of disposal and they have the same problem themselves. They do not have any means of segregating litter when it finally reaches the landfills meaning that there could be some pesticides disposed with general waste. (However the city council normally refer to private companies offering disposal services) e.g. Most of the schools have obsolete pesticides dating to 20 years back but they still do not know how to dispose them.

The use of chemicals requires proper personal protective clothing to protect the user from harm of chemical dangers such as spills. The basic protective clothing would include water and acid proof coats, acid proof sole boots, gloves, masks and goggles. Depending on the toxicity of the chemical and the environment under which it is used, more may be required. It was observed that there is knowledge on the importance of proper protective clothing, though it was found that some of the people worked without them. This problem in most cases is caused by management not providing their staff with adequate protective clothing. Some farmers however indicated that they did not wear protective clothing because of discomfort and heat trapping.

The level of knowledge on POPs pesticides is still very low. During the oral interviews, it was observed that most of the farmers and industry personnel did not know much about POPs.

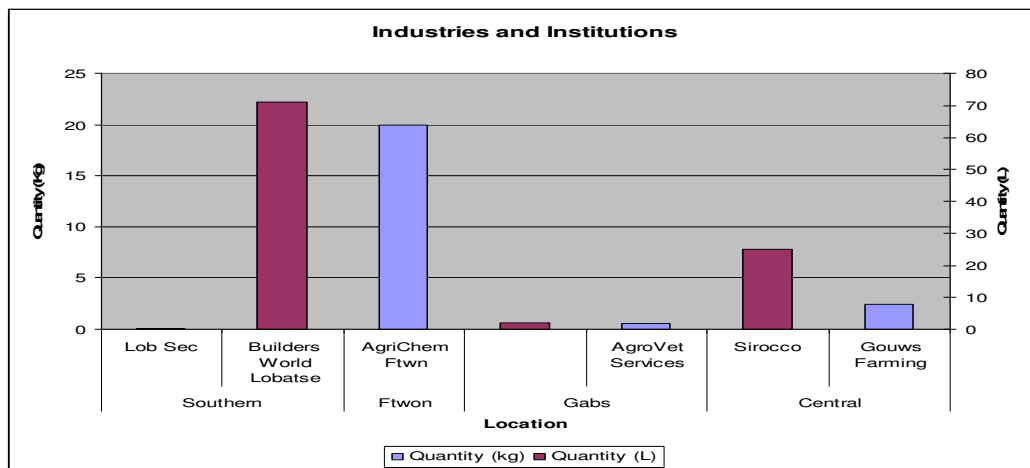
According to Botswana legislation (Waste Management Act of 1998), it is the responsibility of the polluter to clean and rehabilitate the polluted site. There was no contaminated site located in this survey. It cannot however be concluded that there is no contaminated site in the country.

There is no importation of POPs pesticides in the farming community that was surveyed. The survey was done in such small dealers as Agricop, Agrichem, Agrifeed and many other supply farmers with crop protection products. This is inclusive of DDT as a pesticide.

Due to the fact that there is no manufacture of pesticides locally it is therefore hypothesized that export of the foregoing is non existent.

Industrial chemicals specifically chlordane is used in the construction industry. The quantities, which were inventorised are provided in Figure 5. Botswana will immediately stop the import and use of chlordane as per Article 3 of the Stockholm Convention.

There was also a stock pile of about 3000 Odour Bated Targets (OBT) that was meant for controlling the tsetse fly. Although the active ingredients of the OBT are non POPs, they are having a problem of disposing off these remains.



**Figure 5: Quantities of POPs Pesticides (Chlordane) in Industries and Institutions by Location**

### 2.3.1.7 Gaps Challenges and Constraints

Some chemicals did not have labels due to poor handling and poor storage. This resulted in labels being torn off or faded due to spillages. Some of the chemicals were stored in the open spaces such as tree trunks and labels got destroyed by the sun. Some of the pesticide did not have labels from the repackaging and distributing companies. Due the above mentioned, it was impossible to get the exact name of the product. In recognition of the fact that the pesticide label is a legal document that must provide all the truthful information about the contents: the label was therefore used as the only marker and there were no means of verifying otherwise.

### **2.3.1.8 Recommendations**

- The task team acknowledges that in the absence of other task team members the survey and other duties relating to this project are lacking behind. It is therefore recommended that the task team members are availed as their contributions from different institutions are of high importance.
- The task team recommends that samples be obtained from the retailers for testing to verify what is indicated on the labels and substantiate our findings.
- There is need for intensive knowledge dissemination to the public at large on POPs pesticides beginning with the repackagers and distributors who in turn can teach their customers.
- The pesticides that are repackaged in Botswana need to be registered in accordance to the Agrochemicals Act of 1999. In this way their labels, distribution and use may be regulated.

## **2.3.2 Assessment with respect to Annex A, part II chemicals (PCBs)**

### **2.3.2.1 Summary**

The Botswana National Polychlorinated Biphenyls (PCBs) Inventory report is prepared in accordance with the requirements of the Stockholm Convention on Persistent Organic Pollutants. The objective of the PCB inventory exercise is to determine the quantities and qualities of PCB in various sources and localities. The overall objective is to phase out production and use of PCB. The inventory will also inform Botswana's strategies for PCB handling and disposal.

A total of 619 oil-containing equipments (predominantly transformers) were tested for PCBs using the (Clor -N- Oil 50) test kit suggested by United Nations Environmental Programme (UNEP). The tested equipment constitutes about 10% of the national existing equipment. Test results indicated that about 54% of all the tested equipment were PCB contaminated. While the other 46% of equipment were either PCB free or the PCB content was below the detectable limit of the kit (50 ppm). A total weight of PCB contaminated equipment is approximately 43 120 tonnes, while the volume of PCB contaminated oil amounts to 16 520 m<sup>3</sup>.

The age of equipment that tested PCB positive ranged from as old as the year 1969 to as recent as 2005. This phenomenon indicates that Botswana continues to receive PCB containing equipment despite the fact that more developed countries have since phased out the use of PCB. However, there is a declining trend in the number of PCB containing

equipment. The test results also indicated that some equipment manufactured by certain manufacturers, consistently tested positive.

PCB disposal options continue to pose a challenge for Botswana, since the country does not have appropriate storage and disposal facilities. However, disposal facilities are available in some developed countries, at a significantly high cost.

### **2.3.2.2 Introduction**

The Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted in May 2001 in Stockholm, Sweden. Under this convention, twelve persistent organic pollutants were identified as posing a major and increasing threat to human health and the environment at large. The objective of the convention was to reduce the risk to human health and the environment arising from the twelve POPs (aldrin, chlordane, DDT, dieldrin, dioxins, furans, endrin, hexachlorobenzene, heptachlor, mirex, Polychlorinated Biphenyls (PCBs) and toxaphene).

Polychlorinated Biphenyls popularly known as PCBs are a group of synthetic chemicals that primarily consist of two fused benzene rings and two or more chlorine atoms. They are mostly used as insulating fluids in electrical transformers, capacitors and other electrical equipment because of their good insulating capacity and fire resistance. These chemicals were phased out in the late 1970s because of health concerns, they bio accumulate and they are not biodegradable. Studies in animals have shown that PCBs are carcinogenic and affect the immune system, the reproductive system, the nervous system and the endocrine system as well. However in most developing countries PCB continue to be used since there is no legislation against their use.

Botswana became a party to the Stockholm Convention in October 2002. PCBs are also included within the scope of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal and the Rotterdam Convention on the "Prior Informed Consent" Procedure. Botswana as a SADC member country and a signatory to the Stockholm Convention is required to develop its National Action Plans to identify, characterize and address the release of PCBs with the aim of phasing out the use of PCBs by 2010 in accordance with the SADC deadline.

Pursuant to Stockholm Convention Botswana committed herself to establish a national PCB inventory, under the auspices of the United Nations Environment Programme (UNEP). The main objective of the inventory exercise is to determine the quantity and quality of PCB containing and contaminated equipment and sites. Under the convention, production and use of persistent organic pollutants, specifically PCBs must be phased out by the year 2025. However, SADC member countries have decided to phase out PCBs by 2010.

The exercise was carried out in accordance with Annex A part II of the Stockholm Convention, where each member country is required to undertake the following:

- Make determined efforts to identify, label, and remove from use equipment containing greater than 0.005 percent PCBs and volumes greater than 5 litres.
- Make determined efforts designed to lead to environmentally sound waste management of liquids containing PCBs and equipment contaminated with PCBs content above 0.005 percent.
- The effort to manage waste should be done as soon as possible but not later than 2028.

The Department of Waste Management and Pollution Control assisted by the Botswana Power Corporation conducted a nation wide PCB inventory between the months of July and August 2006. The country was divided into 3 regions; north, south and central. Several equipment owners were visited, these include among others BCL mine, Tati Nickel mine, Jwaneng mine, Orapa mine and Botash (Table 4).

### **2.3.2.3 Methodology**

#### **PCB Inventory Workshops**

The department of waste management and pollution control conducted two stakeholder workshops October 2004 and April 2005, respectively. The main objectives of the two workshops were to:

- Set up a coordinating mechanism including the working structure
- Sensitise key stakeholders
- Highlight Botswana's obligation to the POPs convention
- Build capacity to undertake inventories
- Identify priority issues and develop action plans for them
- Train participants to make an inventory of PCBs in the Country.
- Train participants on the sampling procedures of PCB determination and analysis of oil and other material for PCB content.

The workshop identified some critical activities necessary to ensure successful inventory gathering as follows:

- Creation of awareness of PCB stakeholders by holding workshops,
- Identification of PCB technical committee,
- Identification and procurement of test kits and training of PCB technical committee.
- Development of action plans and communication strategies to stakeholder

The workshops were attended by a diverse mixture of participants from government ministries and department, the private sector, Non-Governmental Organizations (NGOs), parastatals and the media. During the workshop, a preliminary inventory exercise was carried out on decommissioned equipment at the Botswana Power Cooperation (BPC) stockpiling sites in Gaborone. A total of 16 transformers, 2 capacitors, 1 switch gear, and 5 oil containing drums were tested and labelled. Soil samples from 7 different locations where spillages had occurred around the substation were also taken and tested. The test results indicated that there were no PCBs in the samples.





## **Field Work Inventory**

The Department of Waste Management and Pollution Control coordinated the PCB inventory compilation exercise. The country was divided into three regions, being the south, central and the north. Three teams were assigned to carry out the national inventory in each of the region, respectively. Each team was comprised of four members mainly from the department of Waste Management and Pollution Control and also from the Botswana Power Corporation. The inventory was conducted between the months of July and September 2006. The activities during this period included preparations for the field trip, field trips in the three regions, data entry and analysis.

Equipment owners and operators were requested to allow the various teams access to their facilities in order to conduct the inventory. Sampling and tests were conducted in the presence of the owner or their representative. The teams tested equipment manufactured between 1969 and 2005.

Oil samples were taken from the various pieces of electrical equipment, mainly transformers. The sampling points are usually located near the bottom hence the oil is easily collected due to gravity. Pipettes were used in cases where samples were obtained from the top of equipment. The test requires only 5ml of oil, so only small amounts were extracted from the equipment. Tests were conducted using the PCB test kit (CLOR- N- Oil 50) provided by UNEP.

During the sampling and testing exercise, personal protective equipment was used to ensure the safety of the teams and other operatives.

The three teams conducted the inventory exercise in various parts of Botswana. The first team covered the following districts: Kgatleng, Kweneng, Southern, Kgalagadi, Ghanzi, South East, Gaborone and Lobatse. The second team covered: Chobe, North West, North East and Francistown and its periphery. While the third team covered the Central district and Selibe Phikwe.

Inventory collection forms were adapted from the UNEP forms. The forms were used to capture data on the condition, accessibility and security of the equipment and information on nameplate (equipment manufacture, year of manufacture, weight). All tested equipment were identified by way of labels, which revealed their PCB status.

### **2.3.2.4 Inventory findings**

#### **Closed and semi-closed applications of PCBs**

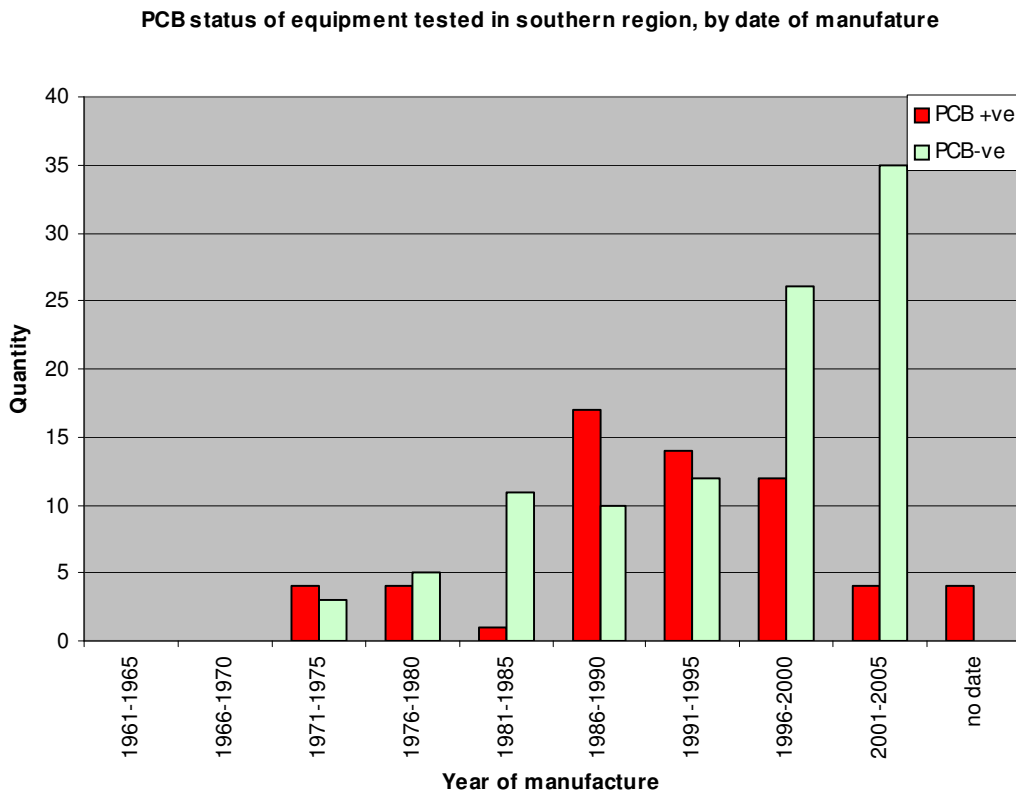
Closed and semi-closed applications of PCBs cover most of the PCBs used in the country. These were combined into one section for the purpose of the inventory, because the major sources and users of PCBs are the same, which is mainly the power generation and distribution industry. The equipment includes but not limited to; transformers, capacitors, dielectric fluids, ballast of electric lights, electromagnets and electric motors. In Botswana more than 90% of the closed and semi-closed applications in use are transformers hence the inventory focused on transformers.

Some 619 transformers were tested during the inventory compilation exercise. It is estimated that there are 6000 transformers in use and about 1000 in stockpiles. The combine figures translate to a total of 7000 transformers country wide. The tested equipment constitutes about 10% of the national existing equipment. Test results indicated that about 56% of all the tested equipment

were PCB contaminated. While the other 44% of equipment were either PCB free or the PCB content was below the detectable limit of the kit (50 ppm). A total weight of PCB contaminated equipment is approximately 43 120 tonnes, while the volume of PCB contaminated oil amounts to 16 520 m<sup>3</sup>.

### Southern Region: Discussion of Results

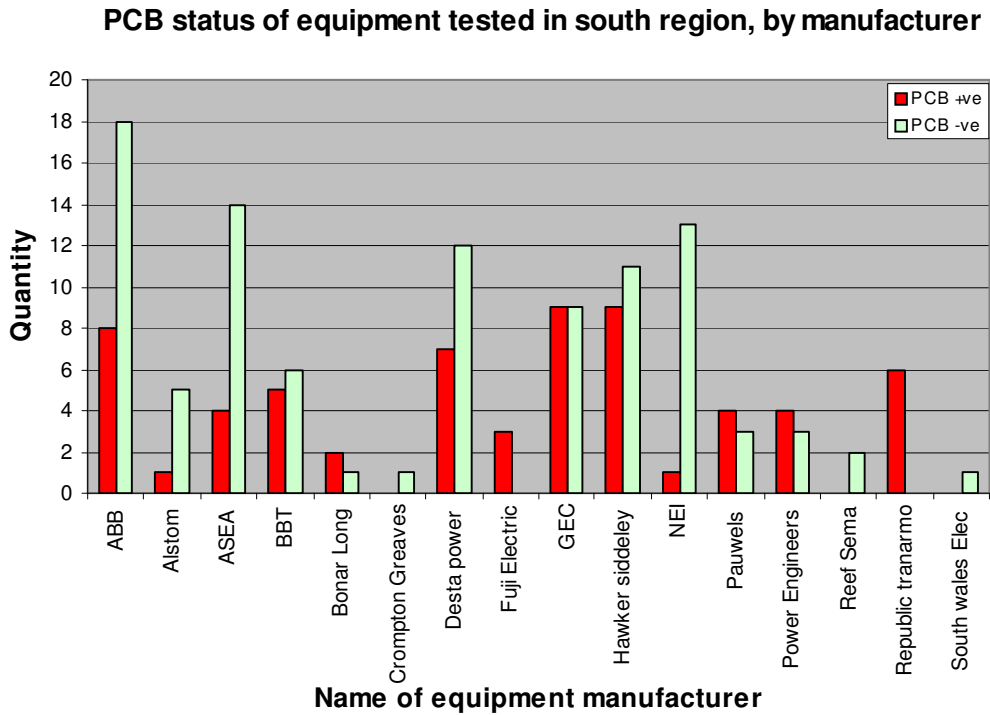
In the south region a total of 196 oil containing pieces of equipment were visited. However, 35 had no sampling points or were not accessible for sampling and 161 were tested for PCBs. A total of 60 (37 %) pieces of equipment tested positive for PCB, while 101 (63 %) were either PCB free or the PCB content was below the detectable limit of the kit (50 ppm). Equipment manufactured in the period 1986-1990 had the highest PCB positive status. This phenomenon could have been a result of manufacturers dumping their PCB contaminated equipment to Botswana. Significant decreases in PCB positive equipment is noted during the period after 2001. This may be attributed to increased awareness for PCB free equipment on the part of the equipment owners (Figure 6).



**Figure 6: PCB contaminated and PCB free equipment by year of manufacture - South region**

Based on equipment manufacturer, the data showed that for all equipment tested in the south, GEC and Hawker Siddeley had 9 pieces of PCB contaminated equipment each, these were the highest followed by ABB with 8 pieces of contaminated equipment. All 6 Republic Tranarmco pieces of equipment tested positive. NEI had more than 88% of their equipment falling within

PCB free category. All equipment supplied by Fuji electric, Reef Sema and South Wales Electric that were tested in this region indicated no presence of PCBs (Figure 7).



**Figure 7: PCB contaminated and PCB free equipment by manufacturer- south**

The number of transformers that belong to BPC make up more than 80% of all the transformers in the southern part of the country. It was found that 42 pieces BPC equipment contained PCBs, constituting about 75% of all the PCB positive equipment (Figure 8).

### PCB status of equipment tested in South region by owner



Figure 8: PCB contaminated and PCB free equipment by owner – south

Equipment from South Africa represented 91% of all the electrical equipment in the southern. South Africa contributed 93% of all the PCB positive equipment in the southern region (Figure 9).

### PCB status of equipment in Southern region by country of origin

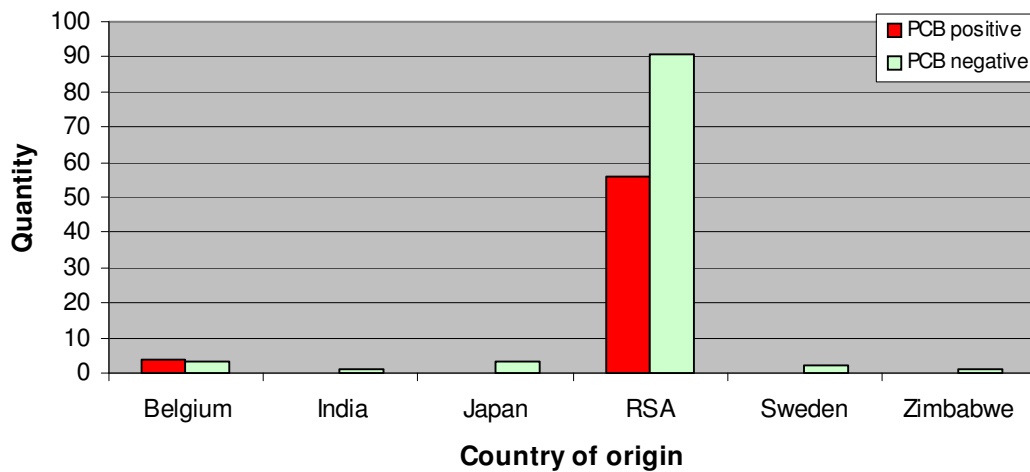
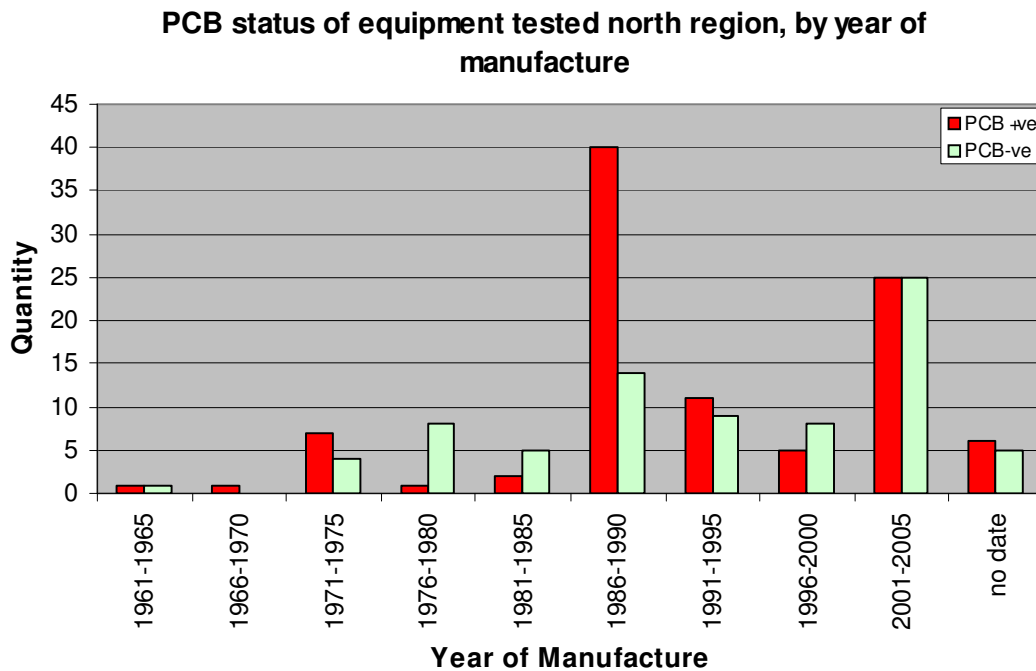


Figure 9: PCB contaminated and PCB free equipment by country of origin - south

### Northern Region: Discussion of results

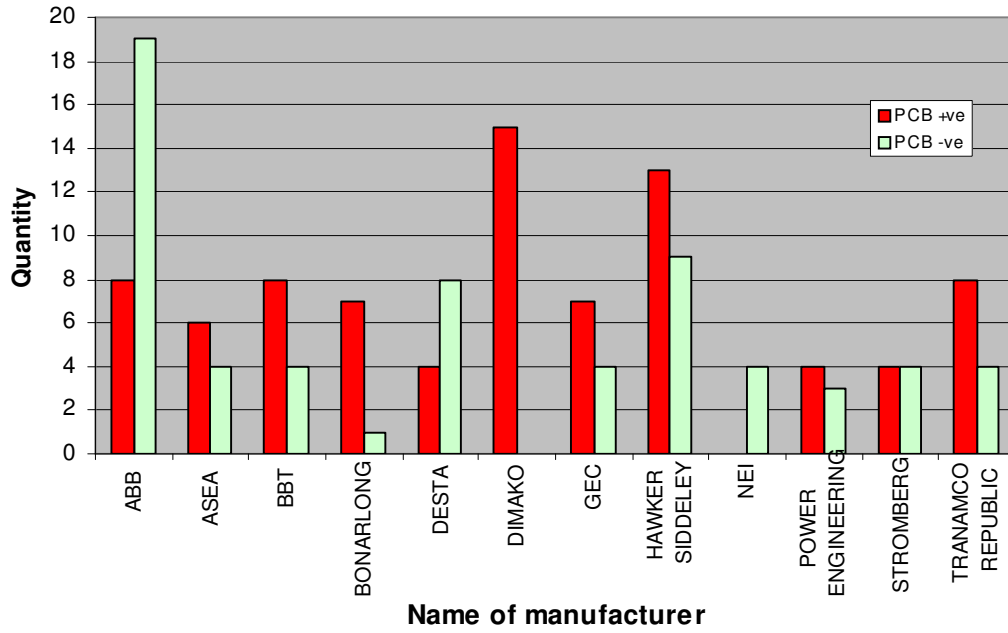
In the north a total of 178 pieces of equipment was tested for PCB status. The age distribution of all the equipment that was tested ranged from 1960 – 2004. About 55% (92) of all equipment assessed tested positive for PCB. The period 1986-1990 had the highest numbers of equipment that tested positive for PCBs. There is a significant downward trend in PCB positive equipment in the period 1991-2000. The number of equipment contaminated by PCBs rises significantly for the period 2001 to 2005, this can be attributed to the mining boom in Northern Botswana during that period. Equipment manufactured during the period 1986-1990 had the highest PCB positive status. This constitutes 40% of all the PCB positive equipment in the region. The period 2001-2005 had the second highest PCB positive equipment status, constituting 25% of all the PCB positive equipment in the region (Figure 10). For those manufactured in the 1960s only two transformers were identified and one tested positive while the other tested negative.



**Figure 10: Equipment by Years of Manufacturer & PCB Status-North**

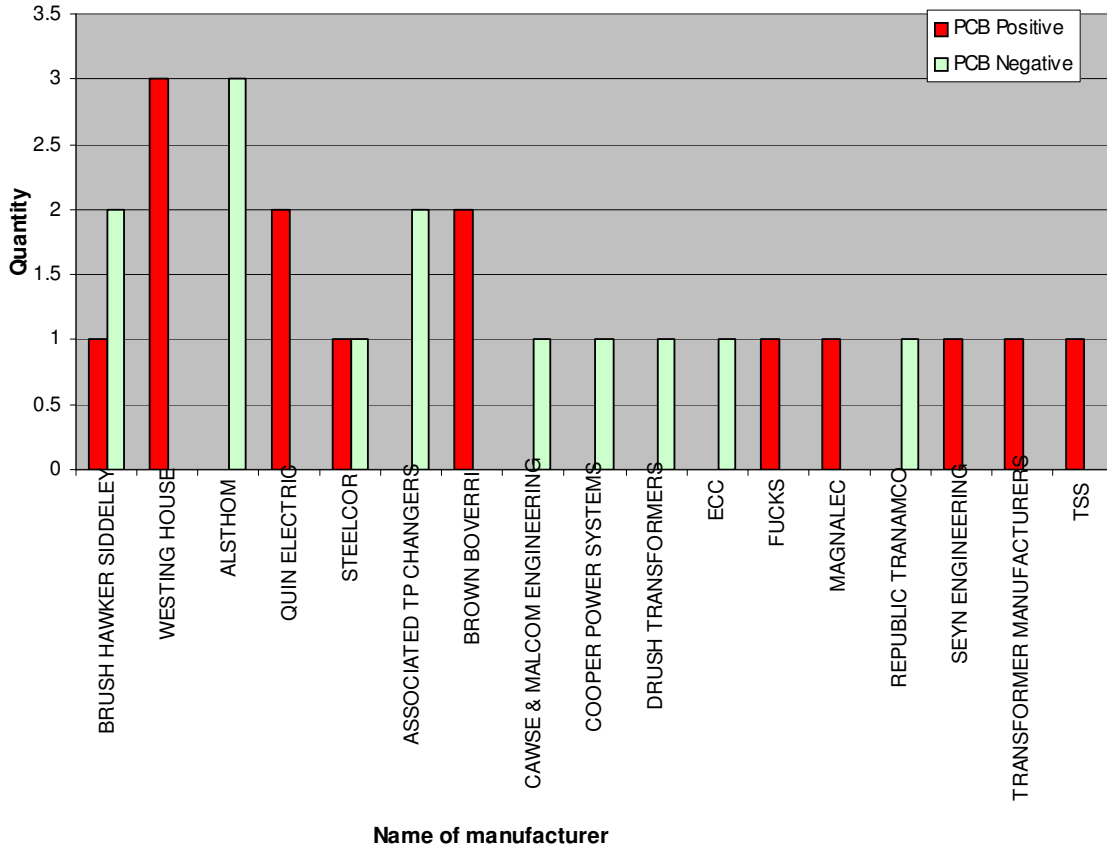
The North has a diverse number of equipment from different manufacturers as denoted by the two graphs, figure 5a, and figure 5b. Based on equipment manufacturer, the data showed that for all equipment tested in the North, all 15 Dimako pieces of equipment tested positive. Hawker Siddeley had 13 pieces of equipment testing positive, this was the second highest number. Bonar Long, Tranarmco Republic, ABB and GEC each had 8 pieces of equipment testing positive. (Figure 11, Figure 12).

**PCB status of equipment tested in north region, by manufacturer  
(manufacturers with more 4 or more items)**



**Figure 11: PCB Contaminated and PCB free equipment in the North by manufacturer (4 or more items)**

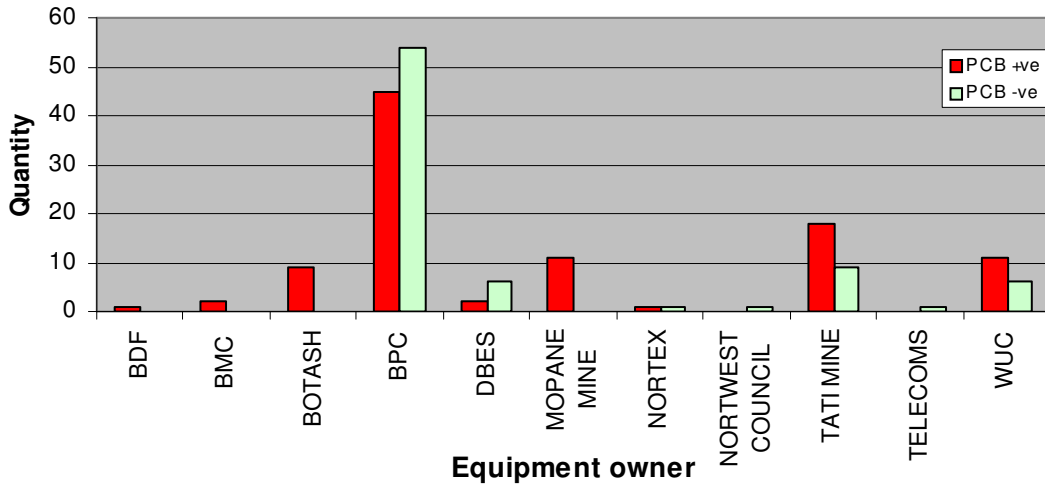
**PCB containing equipment in northern region, by manufacturer  
(manufacturers with less than 4 items)**



**Figure 12: PCB contaminated and PCB free equipment in the North by manufacturer**

In northern Botswana, the number of transformers which belong to BPC make more than 50% of the transformers tested. This is understandable since BPC is the only power utility in the country and owns most of the power equipment in consideration. BPC had the highest number of PCB contaminated equipment, followed by Tati mine, Mopani mine and Botash with 45, 18, 11 and 9 pieces of PCB contaminated equipment respectively (Figure 13).

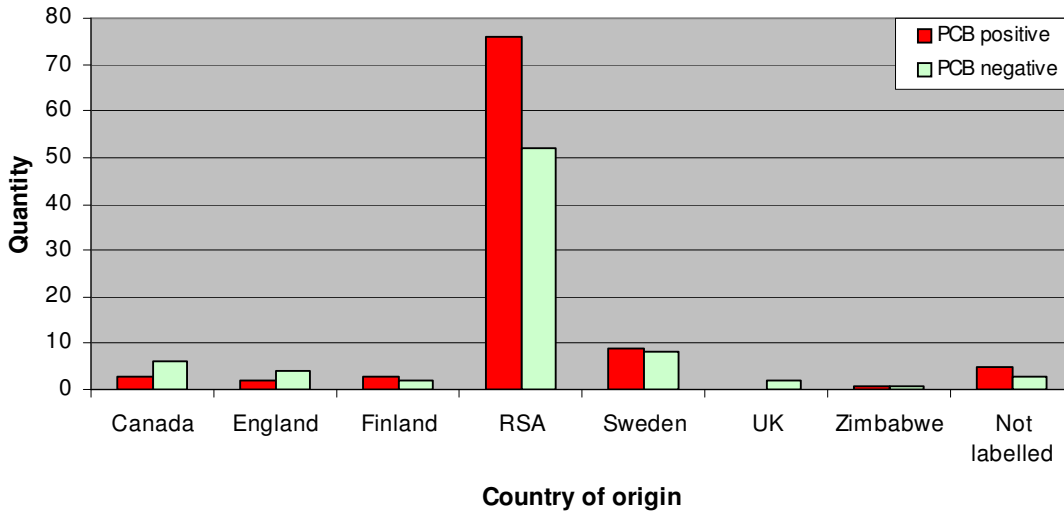
**PCB status of equipment tested in Northern region, by equipment owner**



**Figure 13: PCB contaminated and PCB free equipment in the North by owner**

Equipment from South Africa represented 72% of all the electrical equipment in the southern. South Africa contributed 77% of all the PCB positive equipment in the northern region (Figure 14).

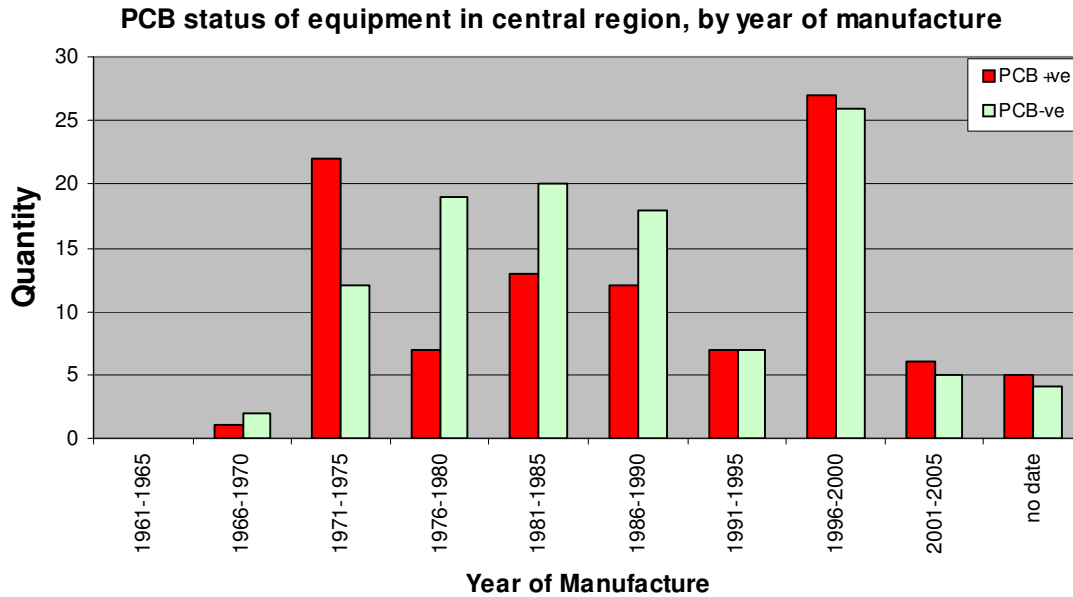
**PCB status of equipment in North region by country of origin**



**Figure 14: PCB contaminated and PCB free equipment by country of manufacture**

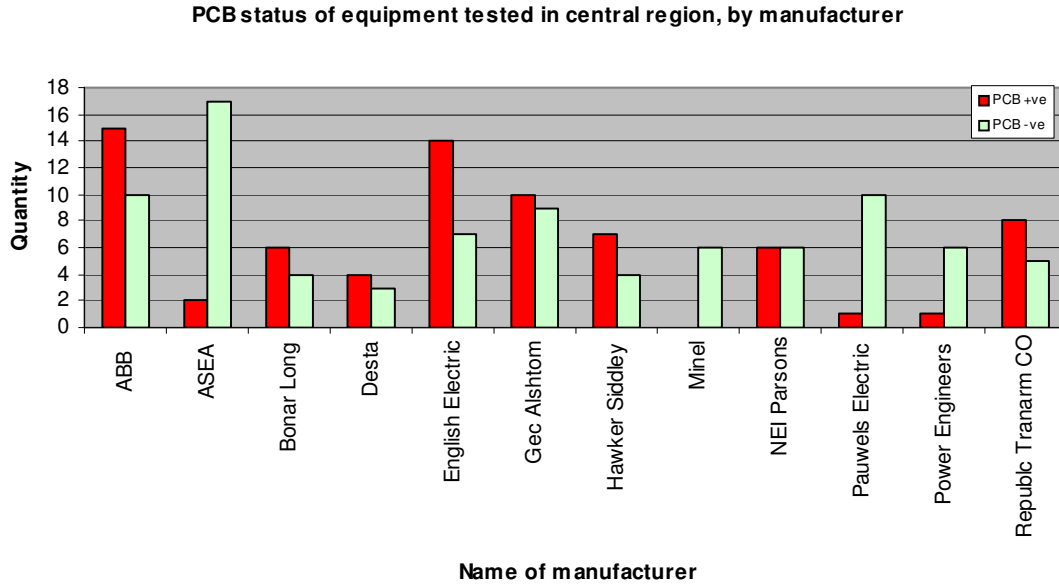
**Central Region: Discussion of Results**

In the Central a total of 214 oil containing pieces of equipment were assessed for PCBs and 27 had no sampling points or were not accessible for sampling. The period 1996 -2000 had the highest number of PCB contaminated equipment at 27 pieces; this is a bit puzzling since PCB contaminated equipment had been phased out. This is strong evidence for dumping of such equipment by some suppliers. The period 1971-1975 had the second highest number of PCB containing equipment at 22 pieces, possibly due to the establishment of the Debswana Orapa diamond mine and the BCL copper/nickel mine (Figure 15).



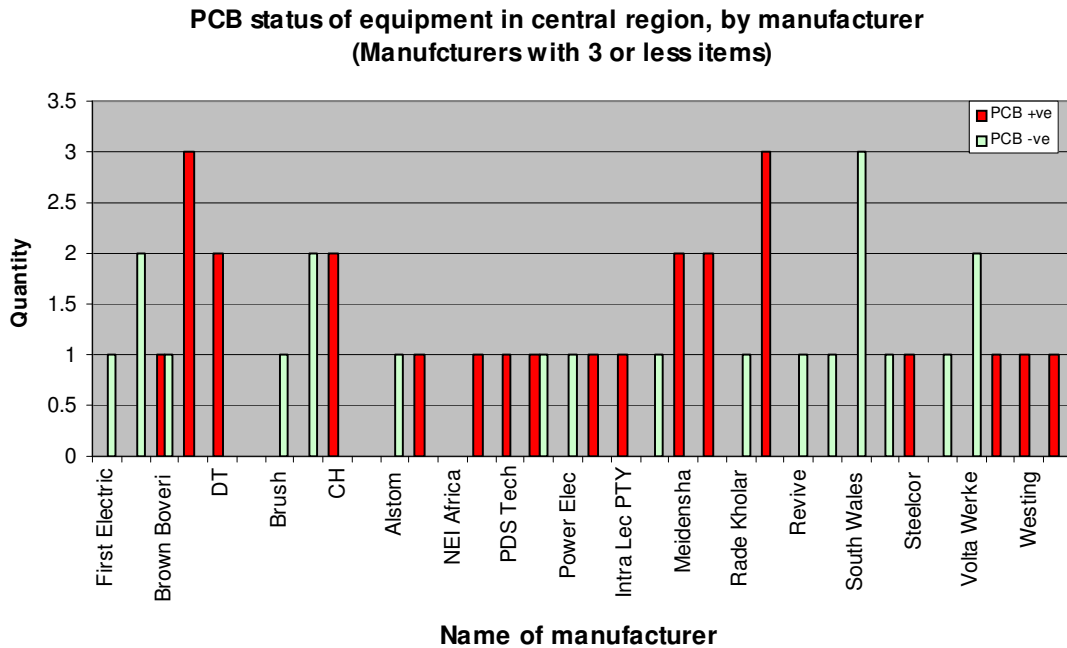
**Figure 15: PCB contaminated and PCB free equipment in the central region by year of manufacture**

ABB was the manufacture with the highest number of PCB contaminated equipment in the central region, it was followed by English Electric, GEC Alsthom, Republic Tranarmco and Hawker Siddeley at 15, 13, 10 and 8 pieces of equipment respectively (Figure 16).



**Figure 16: PCB contaminated and PCB free equipment in the central region by manufacturer (4 or more items)**

Equipment from South Africa represented 70% of all the electrical equipment in the southern. South Africa contributed 80% of all the PCB positive equipment in the central region (Figure 17).



**Figure 17: PCB contaminated and PCB free equipment in the central region by manufacturer (Less than 4 items)**

BCL had the highest number of PCB contaminated equipment, 37 in total and this represented 39% of all PCB positive equipment tested in the region. This was followed by BPC and Morupule power station with 20 and 15 pieces of PCB contaminated equipment respectively. BCL operates the Copper/Nickel mine and therefore has a lot of electrical equipment for their mine; this explains why it owns more PCB contaminated equipment than BPC (Figure 18, Figure 19).

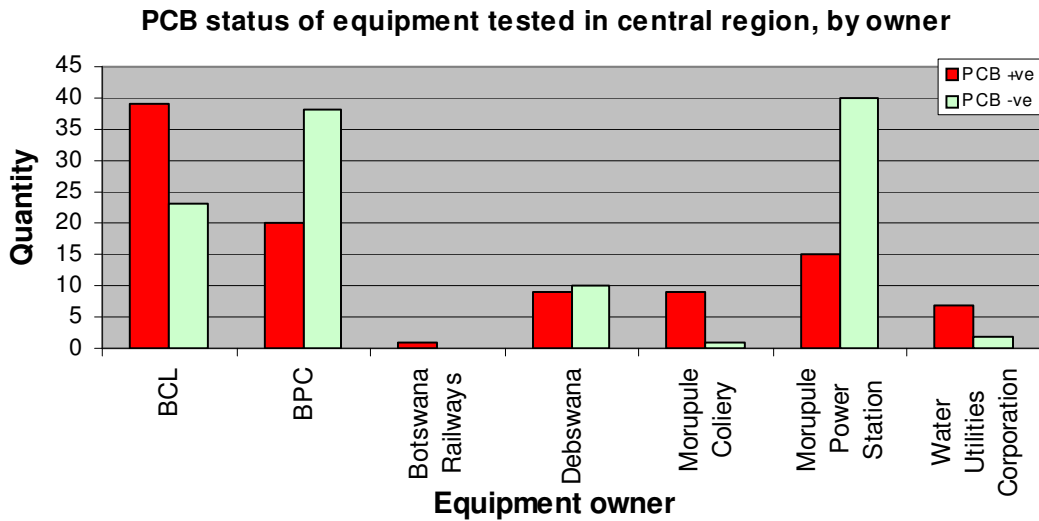


Figure 18: PCB contaminated and PCB free equipment in the central region by owner

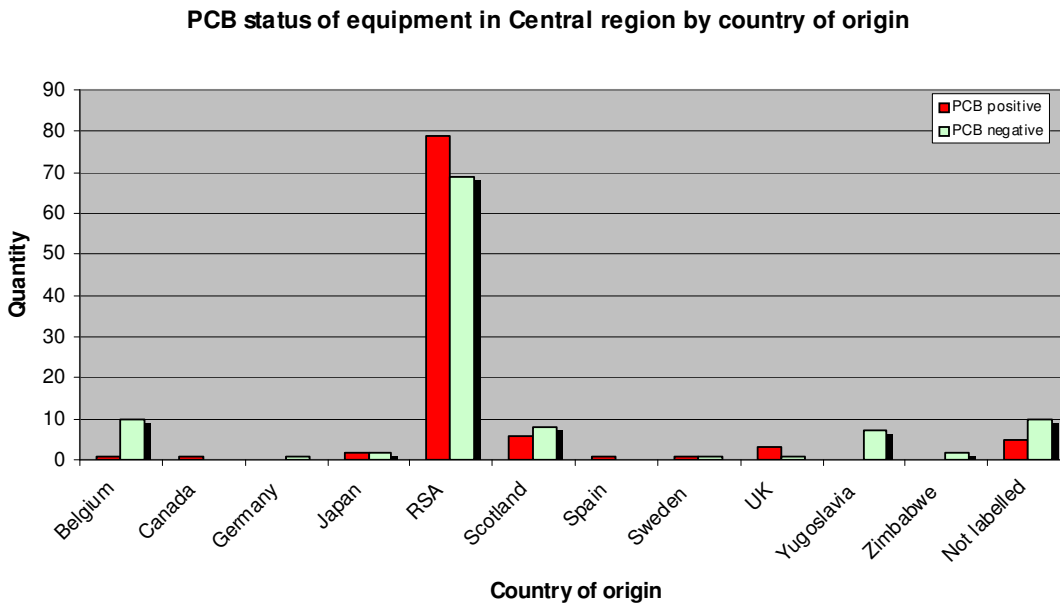
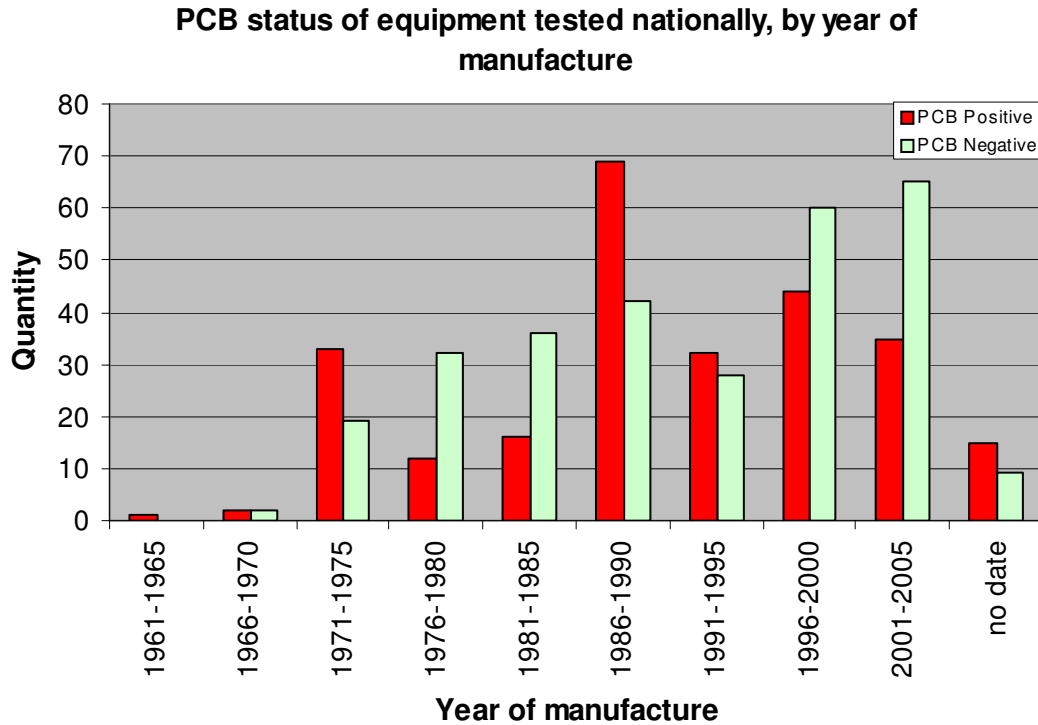


Figure 19: PCB contaminated and PCB free equipment in the central region by owner

### 2.3.2.5 National Discussion of results

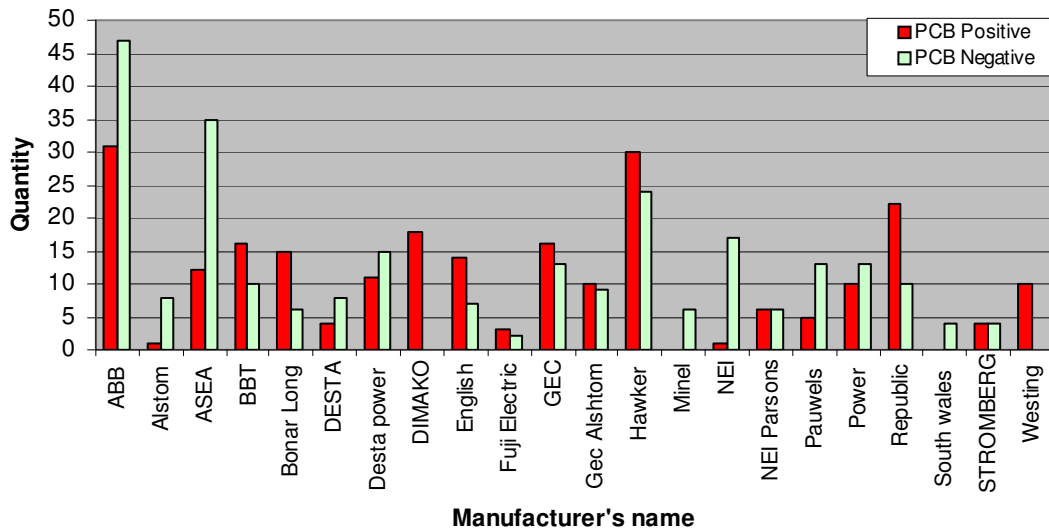
Equipment manufactured in the period 1986 – 1990 had the highest numbers of PCB contamination. This equipment constituted 27% (69) of the PCB positive equipment. These high numbers might be due to suppliers dumping PCB positive equipment in Botswana. This was followed by the period 1996-2000 and 2001-2005 at 17% and 14% respectively. It was also noted that equipment manufacture as recent as the period 2001-2005 had a significant number of PCB positive equipment (Figure 20).



**Figure 20: PCB contaminated and PCB free equipment Nationally by year of manufacture**

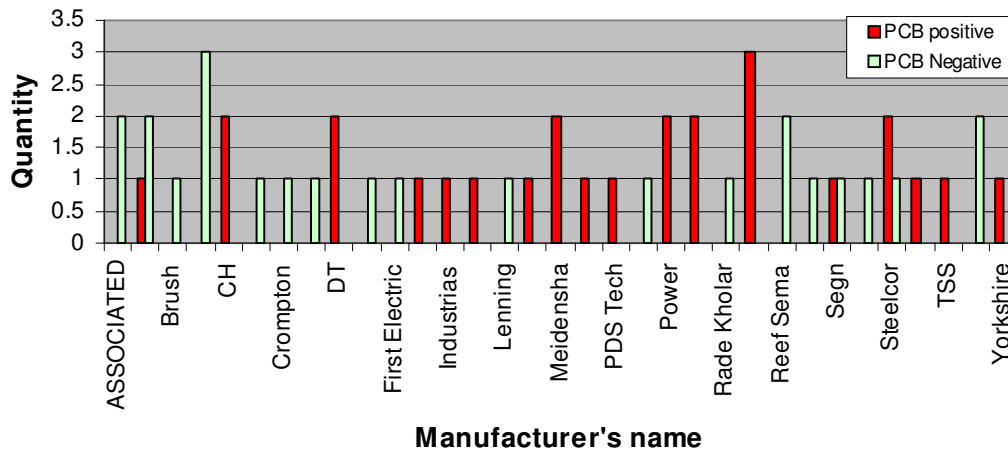
ABB, Hawker Siddeley and Republic Tranarmco were the top three manufacturers with high numbers of PCB contaminated equipment at 31(12%), 30(11%), 22(8.3%), respectively. All in all there were 56 different equipment manufacturers. For all the regions ABB and Tranarmco Republic are in the “top five” group of PCB containing equipment (Figure 21, Figure 23).

**PCB status of equipment by manufacturer- Nationally  
(Manufacturers with more than 3 pieces of equipment)**



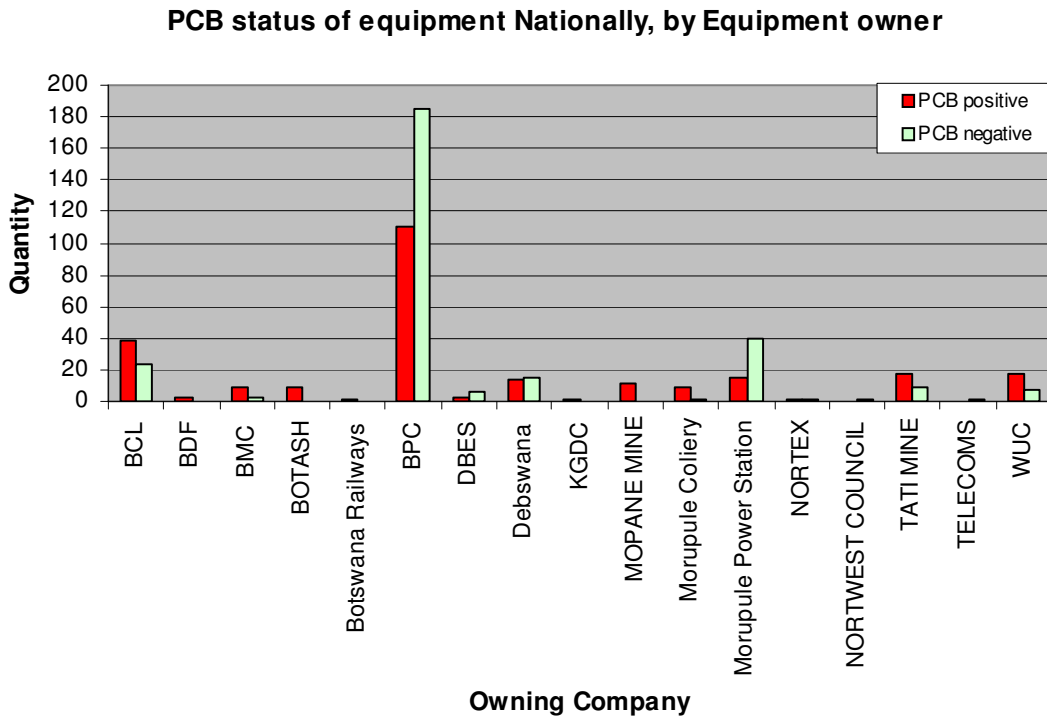
**Figure 21: PCB contaminated and PCB free equipment nationally by manufacture (Manufacturers with more than 3 pieces of equipment)**

**PCB status of equipment by manufacturer - Nationally  
(Manufacturers with 3 or less pieces of equipment)**

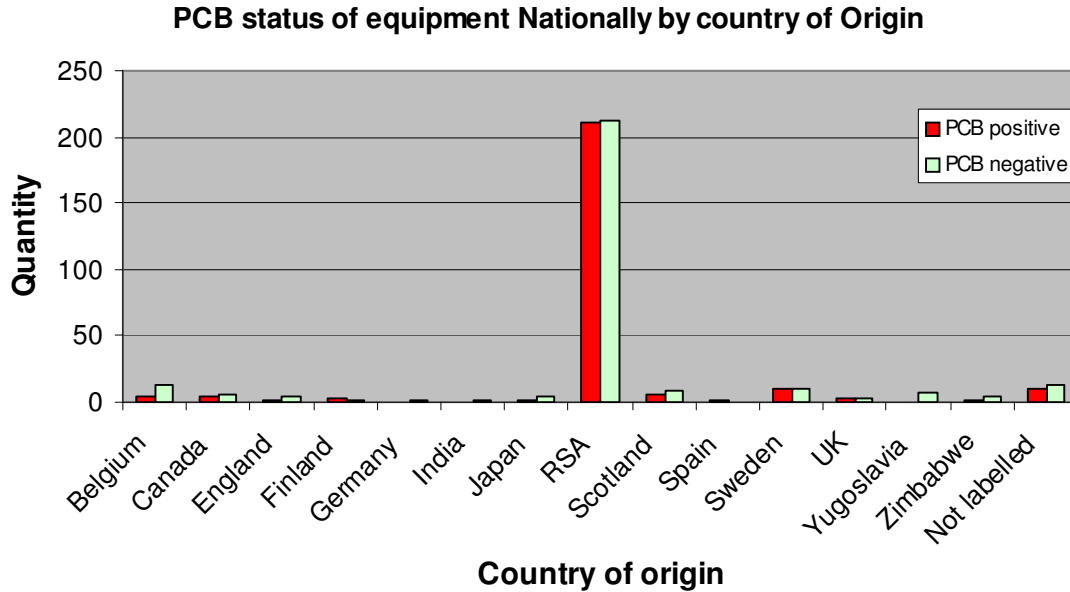


**Figure 22: PCB contaminated and PCB free equipment nationally by manufacture (Manufacturers 3 or less pieces of equipment)**

Nationally, BPC has the highest number of equipment tested as well as the highest number of PCB positive equipment. BCL had the second highest number of PCB positive equipment; all this equipment is located in the area around the Copper/Nickel mine. BPC and BCL had 110 and 37 pieces of PCB positive equipment respectively; this represented 42% and 12% of all the PCB contaminated equipment respectively. Water Utilities Corporation had 18 pieces of PCB positive equipment. Tati Nickel mine and Mopani mine have 18 and 11 pieces of PCB positive equipment respectively. These are new mines which are expanding and have the potential of acquiring more PCB positive equipment (Figure 23, Figure 24).



**Figure 23: PCB contaminated and PCB free equipment nationally by owner**



**Figure 24: PCB contaminated and PCB free equipment nationally by country of origin**

**2.3.2.6 Open application of PCBs**

Open applications of PCBs include plasticizers like PVC, surface coatings e.g. carbonless copy paper, adhesives, especially those for waterproofing walls, inks, casting waxes and lubricants for instance cutting oils. These types of applications are believed to be very small in Botswana. In this report open applications were not considered during the PCB inventory exercise.

**2.3.2.7 PCB containing wastes**

**Waste Management**

At present there are no hazardous waste management companies in Botswana. Hazardous waste management facilities capable of handling PCB containing wastes are available abroad, but this is a very expensive exercise. All the obsolete electrical equipment which contains PCBs in Botswana is currently stockpiled. It has been estimated that about 1000 pieces of equipment are currently stocked. Using the same trend from the tested equipment, the stockpile would contain about 500 PCB positive pieces of equipment.

**2.3.2.8 Limitations**

According to the manufacture of CLOR-N-Oil, Dexsil Corporation, the CLOR-N-OIL 50 kit is used for the qualitative analysis of PCB. A PCB positive result shows that the oil may contain more than 50 ppm PCB. The kit works on the principle of chlorine determination. Since PCBs are chlorine-based materials, the kit is able to detect their presence in a sample. However, the test cannot distinguish between any other chlorine-containing substances such as trichlorobenzene which may also be found in transformer oil. These compounds may cause a result known as “false positive”, i.e., the oil will indicate the presence of over 50 ppm PCBs, but when analysed by gas chromatography will show a value less than 50 ppm. Presence of chloride compounds such

as contamination by salt (sodium chloride), sea water, perspiration, etc will also give false positive results hence the necessity for further laboratory testing.

Inaccessibility of equipment was another limitation in this exercise, some owners especially the farming community and the mining industry were very uncooperative. They were reluctant and even refused us entry to their pieces of equipment that we were interested in testing.

Electrical equipment in Botswana is sparsely distributed over a large area making it difficult to access some remotely placed pieces of equipment. There was a shortage of resources which compounded this problem even more. There were limited funds, manpower and time. For the most part in conducting this inventory we relied on BPC personnel and who we had no control over

There was a conflicting status of equipment, some equipment with a “PCB negative” stamp tested positive for PCBs. Some pieces of equipment tested did not have name plates at all making identification very difficult.

During the inventory exercise the teams did not have GPS equipment and as such did not plot the GPS coordinates of the various pieces of equipment tested.

### **2.3.2.9 Conclusion**

Equipment manufactured in the period 1986-1990 had the highest incidences of PCB positive equipment in Botswana, contributing 27%(69)of all the PCB positive equipment. This was followed by the period 1996-2000 and 2001-2005 at 17% and 14% respectively. ABB, Hawker Siddeley and Republic Tranarmco were the top three manufactures with high numbers of PCB contaminated equipment at 31(12%), 30(11%), 22(8.3%), respectively. BPC and BCL had 110 and 37 pieces of PCB positive equipment, representing 42% and 12% of all the PCB contaminated equipment respectively, they were the two highest owners. Tati Nickel came in third with 18 pieces of PCB positive pieces of equipment contributing 7% of all the PCB positive equipment, these numbers are likely to increase since it's a new mine which is currently undergoing expansion.

Developed projects may have caused the high numbers of electrical equipment in the country. Since there was no monitoring system or legislation against PCB containing equipment in Botswana, this might have resulted in the high numbers of PCB contaminated equipment in the later years. Some suppliers might also have taken advantage of the lack of a monitoring process to dump PCB containing equipment in the country.

### **2.3.2.10 Way forward**

In accordance with article 10 of the convention on public information, awareness and education, communication strategies were developed for the five (5) different target groups as follows:

- Policy makers/politicians
- Top managers/Decision makers
- Technicians, procurement officers, operatives
- General public
- Media

For each of the target groups, appropriate forums will be established. Table 3 below displays the 5 target groups, the discussion forums for each target group, and the objectives for

communication. The subject matter and the material required for the communication are also included in table.

Prior to the final PCB disposal, Botswana would in the interim engage in the following activities:

- Encourage progressive phasing out of PCB
- Prohibit further importation of PCB containing equipment
- Intensify stakeholder PCB awareness

Consider including PCB into the legal frame work

### **2.3.3 Assessment with respect to Annex B chemicals (DDT)**

#### **2.3.3.1 Introduction**

While the country can talk of a long history of DDT, the insecticide was used only for malaria vector control. Since 1998 the Ministry of Health has never imported the insecticide for use in public health. As a requirement of the Stockholm Convention DDT use should be restricted for malaria control only. Countries using and/or producing the insecticide are required by the same convention to report to the secretariat every 3 years on the impact on the diseases. Malaria is a disease so deadly it can kill within hours, yet it is a curable disease. It is also a preventable disease and is prevalent that in some parts of the world there is barely a child who has not suffered by the time of his or her first birthday. Malaria is endemic in over 100 countries. In the SADC region, 88 million people live in malaria transmission areas. More than 21 million people fall sick from malaria each year and about 250-300,000 die of malaria each year.

In Botswana, more adults than children get malaria every year. In years of favorable climatic or weather conditions malaria can appear in areas which are usually without it as was experienced by the Kweneng West and the Kgatleng districts. Epidemic forecasting and precise vector control interventions are therefore very critical. In addition clear-cut stratification and appropriate application of vector control interventions are equally critical.

#### **2.3.3.2 Institutional and regulatory framework**

DDT use in IRS dates back to the earlier 1950s and has been used until 1997. It was discontinued in 1998 and replaced with Pyrethroids. The reasons for discontinuing the use of DDT were due to pressure from International Environmental Lobby Groups and primarily Procurement Difficulties.

SADC Health Ministers Convention, 2 April 2006 – Durban, SA, Acknowledged the value of IRS with DDT in the fight against Malaria. The Convention reaffirmed the acceptance of the use of IRS with DDT in the SADC region. Otherwise there are no standing orders banning the use of the product within the boundaries of the country.

#### **2.3.3.3 Past, present and projected future production and use of DDT**

Following the withdrawal of the use of DDT in 1997, the Ministry of Health made a deliberate move not to ban its use rather lobbied for its continued use. That was an important decision as there was anticipation that in future DDT could become the most appropriate insecticide of choice, especially for malaria vector control if resistance to the pyrethroids occurred. The above mentioned factors, which caused the suspension of DDT use for Botswana, were not strong and

good enough reasons to warrant for the ban of the insecticide for malaria vector control given the situation on ground.

While a standing position on the use of DDT has not being made formally to the Convention by the Ministry of Health, officials in the Ministry widely anticipate that Botswana will follow the general trend of other African countries and re-adopt the use of DDT for malaria vector control. It is widely believed that currently, appropriate conditions prevail to justify for the re-introduction of DDT in Botswana.

#### **2.3.3.4 Import and export of DDT**

Although importation of DDT was difficult in the past it is anticipated that with a number of countries in the African continent going for the insecticide, procurement will improve as more companies will be going into production. Depending on the logistical processes between the ministries of Health and Local Government, the use of DDT could therefore come as soon as 2008 spraying season.

#### **2.3.3.5 Present management (production, use, stockpile and waste) of DDT and empty containers**

The current arrangement with regard to the use of insecticides (including DDT) for Indoor Residual Spraying is that they shall strictly be procured only by Ministry of Health and subsequently distributed through Entomology Unit to the districts. Currently it is the responsibility of local authorities to handle empty containers once the insecticides have being used. The Ministry of Health however retains the responsibility of dealing with obsolete insecticides.

Following the decision to move from DDT to Pyrethroids arrangements were made by the Ministry of Health to dispose off all the remaining DDT in the country, and that was done through the assistance of a South African company called Avima, which accepted the insecticide for incineration. As such it can be said confidently that there is no DDT in the country which has resulted from its use in malaria vector control.

#### **2.3.3.6 Current capacity and experience in the field of DDT**

The use of DDT in the country dates back to the early 1950s and was used then until 1997 at which time country discontinued its use and replaced it with pyrethroids. It is therefore fair to say the country has the capacity and experience required for the reintroduction of DDT (Table 5).

While DDT is a highly controversial insecticide, a number of factors are considered for justice of its reintroduction.

- Acknowledgement of Malaria as a serious health hazard
- High Vector Susceptibility Levels to DDT see table below.
- Reported Pyrethroid Resistance
- Reports of success stories of malaria control through Indoor Residual Spraying (IRS) with DDT
- Subsequent Resurgence of Malaria in areas where the disease was previously controlled or eliminated before.
- Spread of the disease into areas which were traditionally non-malarious

**Table 5: Vector Susceptibility Level 2006 (Botswana, Entomology Unit, MoH)**

<b>Pesticide used</b>	<b>Average Susceptibility Level %</b>
<b>DDT</b>	<b>97.88</b>
<b>Deltamethrin</b>	<b>92.12</b>
<b>Lambdacyhalothrin</b>	<b>88.89</b>
<b>Permethrin</b>	<b>90.57</b>

### **2.3.3.7 Assignment of responsibility and liability**

Since the program has been decentralised it would then remain the responsibility of local authorities to carry out malaria spraying exercise. The Ministry of health would continue to play the role of coordination and technical advisor.

### **2.3.4 Assessment of releases from unintentional production of Annex C chemicals (PCDD/PCDF, HCB and PCBs)**

This report presents an estimate of dioxins and furans emissions to air, water land, residues and products in Botswana during the calendar year 2006 focusing on subcategories or sectors relevant to the country. The project was conducted as a desk-top study with the aid of a methodology provided by the United Nations Environment Programme (UNEP) Toolkit. This toolkit was developed by UNEP to help in developing the country's emissions inventory using default emission factors.

The inventory exercise considered eight major source categories in the country and these are Waste Incineration, Ferrous and Non-ferrous Metal Production, Power Generation and Heating, Production of Mineral Products, Transportation, Uncontrolled Combustion Processes, Production of Chemicals and Consumer Goods, and Disposal and Land-filling.

The inventory statistics show that dioxins and furans are released to air more than to other media, as releases to air of 256.837 g TEQ per annum followed by releases to land 21.3 g TEQ per annum and with releases to water being 0.047 which is quite insignificant. The results also demonstrate that waste incineration and uncontrolled combustion processes are potentially the most significant sources of dioxins and furans in Botswana. These two source categories contribute approximately 90% of the total dioxin and furan estimates. Emissions to air are contributed most by waste incineration source category being the principal emitter releasing an amount of 203.156 g TEQ per annum following by uncontrolled combustion processes.

The following source categories are the second major sources of dioxins and furans and they are arranged in order of decreasing contribution of their releases to the environment.

1. Ferrous and Non-ferrous metal production
2. Power generation and heating
3. Production of mineral products

These three source categories contribute about 8% of the total estimates of dioxins and furans, with ferrous and non-ferrous source giving approximately 60% of the emissions of this group.

Transportation is the least contributing source category releasing 0.139 g TEQ per annum of dioxins and furans to air. The results also show that disposal/landfilling is the only source category releasing 0.047 g TEQ per annum of dioxins and furans to water.

The overall dioxin and furan emissions for the baseline 2006 amounted to 291.883 g TEQ per annum. The inventory results are subjected to some degree of uncertainties since the study was based on default emission factors.

#### **2.3.4.1 Introduction**

##### **i) The Stockholm Convention**

The Stockholm Convention on Persistent Organic Pollutants (POPs) requires parties to reduce the total releases of unintentionally produced POPs such as polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzo furans (PCDF) with a goal of their continuing minimization and where feasible, ultimate elimination. Accordingly, parties need to identify their sources of dioxins and furans and quantify their releases.

##### **ii) UNEP Toolkit**

In early 2001, the United Nations Environment Programme (UNEP) issued a draft 'Standardised Toolkit for Identification and Quantification of Dioxin and Furan Releases' (UNEP Chemicals, 2001)<sup>14</sup>. This Toolkit has been developed by UNEP to address the lack of standardisation internationally with regard to the national and regional inventories as to facilitate the development of consistent and comparable data.

#### **2.3.4.2 Background information of dioxins and furans**

Dioxin and Furan are generic terms used to denote a single compound or mixture of compounds derived from polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF). Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans are the two unwanted by-products released by a number of natural, industrial processes and chemical reactions, usually involving combustion. Dioxins and Furans are very stable and persistent in the environment due to their physical and chemical properties. These environmental pollutants are introduced in the environment by four routes; air, water, residue and product.

##### **i) Sources of Dioxins and Furans**

Dioxins and furans are pollutants produced as by-products, and they are released unintentionally in the air, water, product and residue. These pollutants are extremely stable and persistent in the environment due to their physical and chemical properties. Dioxins and furans are produced from primary sources for instance in industrial processes and secondary sources like sewage or contaminated sites where enzymatic activity helps in the formation of these pollutants. Primary sources of environmental contamination with these pollutants could be defined under industrial-chemical processes and thermal processes. The formation of dioxins and furans is ideal in the

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<sup>14</sup> United Nations Environmental programme, UNEP (2003), Dioxin and furan inventories-National and regional emission of PCDD/PCDF

presence of the following factors, high temperatures, alkaline media, and radicals in the reaction process<sup>15161718</sup>.

## ii) Formation of Dioxins and Furans

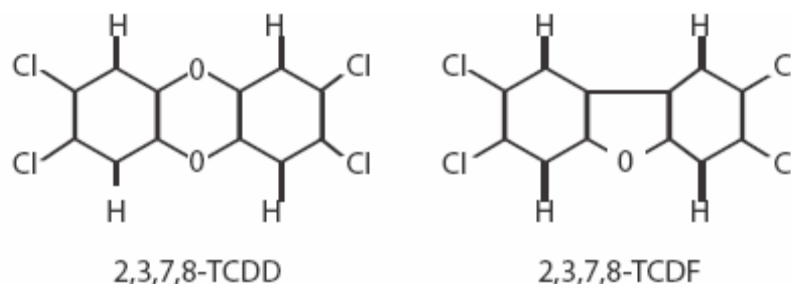
The formation of dioxin and furan is favoured within incineration processes. Their formation is mainly associated with presence of chlorinated hydrocarbons at temperatures above 300 °C within combustion processes. These pollutants are potentially formed during the cooling within a temperature range of 250-450 °C. There are three possibilities that favour the emission of dioxins and furans due to incineration processes;

- Dioxins and furans may already be present in the incoming waste and are incompletely destroyed or transformed during combustion
- These pollutants could be produced from related chlorinated families such as PCBs, chlorinated phenols and chlorinated benzenes.

PCDD/PCDF are formed via de novo synthesis, it should be noted that PCDD/PCDF are not only found in the stack gases but also in the solid residues from any combustion processes like bottom ashes, slag and fly ash (UNEP 2003).

## iii) Physical and Chemical Characteristics

Dioxins and Furans basic structures are consist of two-benzene ring joined by two oxygen atoms, their mixture emitted from combustion sources are in both the gaseous and particulate phase. Dioxins and furans represent 75 congeners of polychlorinated dibenzo-p-dioxins (PCDD) and 135 congeners of polychlorinated dibenzofurans (PCDF). Among these 210 compounds, 17 congeners can have chlorine atoms at least in the positions 2, 3, 7, and 8 of the parent molecule. The distribution of chlorine within the atoms affects the chemical properties of each isomer. Figure 25 represents the chemical structure of the two most toxic isomers of dioxins and furans and (Figure 25) summaries some of the chemical and physical properties of dioxins and furans.



<sup>15</sup> Dr. Heidelore Fiedler. Sources and Environmental Impact of PCDD/PCDF

<sup>16</sup> Jun Jin, Hao Peng, Tang Xiaoyan. (2004) An inventory of Potential PCDD and PCDF Emission Sources in the mainland of China-Nonthermal Sources and Source Inventories 66 ( ), 852,

<sup>17</sup> Kelsey Bawden. (2004) National Dioxin Programme-Inventory of Dioxin Emissions in Australia, Technical Report No. 3

<sup>18</sup> Fergus Hayes and Ian Marnane. (2000). Inventory of Dioxin and Furan Emission to Air, Land and Water for 2000 and 2010- Environmental Protection Agency, 2000-DS-2-M1

**Figure 25: Chemical Structures of the two toxic isomers of dioxins and furans (UNEP Chemicals)**

**Table 6: Chemical and Physical Properties of Dioxins and Furans**

Homologue Group	Molecular weight (g/mole)	Vapour Pressure (Pa x 10 <sup>-3</sup> )	Water Solubility
Dioxins			
M <sub>1</sub> CDD	218.5	73-75	295-417
D <sub>2</sub> CDD	253.0	2.47-9.24	3.75-16.7
T <sub>3</sub> CDD	287.5	1.07	8.41
T <sub>4</sub> CDD	322.5	0.00284 – 0.55	0.0193 – 0.55
P <sub>5</sub> CDD	356.4	0.00423	0.118
H <sub>6</sub> CDD	391.0	0.00145	0.00422
H <sub>7</sub> CDD	425.2	0.000177	0.0024
O <sub>8</sub> CDD	460	0.000953	0.000074
Furans			
D <sub>2</sub> CDF	237.1	14.6	14.5
T <sub>3</sub> CDF	306.0	0.199	0.149
P <sub>5</sub> CDF	340.42	0.0172	0.236
H <sub>6</sub> CDF	374.87	0.0031 – 0.0036	0.0177 – 0.0083
H <sub>7</sub> CDF	409.31	0.00054 – 0.00057	0.00135
O <sub>8</sub> CDF	443.8	0.000101	0.00116

**i) Toxicity Equivalency Concept**

Polychlorinated dibenzo-p-dioxins and dibenzo-furans represent a group of chemical trace compounds which have become ever-present in the environment during the last century.

Many regulatory agencies have developed the so called Toxicity Equivalency Factors, which is for risk assessment of these complex mixtures of dioxins and furans. These toxicity equivalency factors are based on acute toxicity values from in vivo (inside a living organism) and in vitro (outside a living organism) studies. This toxicity equivalency factors approach has been developed as an administrative tool and it allows conversion of quantitative analytical data for individual dioxin and furan congeners into a single Toxicity Equivalent factor. Toxicity equivalency factors particularly aid in expressing cumulative toxicity of complex dioxins and furans as one single Toxicity Equivalency value (Table 7).

**Table 7: International Toxicity Equivalent Factors for Dioxins and Furans (UNEP, 2003)**

Compound	I-TEF	WHO- TEF
2,3,7,8-TCDD	1	1
1,2,3,7,8-PeCDD	1.5	1
1,2,3,4,7,8 HxCDD	0.1	0.1

<b>Compound</b>	<b>I-TEF</b>	<b>WHO- TEF</b>
1,2,3,6,7,8-HxCDD	0.1	0.1
1,2,3,7,8,9-HxCDD	0.1	0.1
1,2,3,4,6,7,8,9-HpCDD	0.01	0.01
OCDD	0.001	0.0001
2,3,7,8 TCDF	0.1	0.1
1,2,3,7,8-PeCDF	0.05	0.05
2,3,4,7,8-PeCDF	0.5	0.5
1,2,3,4,7,8 HxCDF	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1
2,3,4,6,7,8-HpCDF	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01
OCDF	0.001	0.0001

In this emissions inventory, source strengths are estimated as annual mass flow rates of dioxins expressed in grams TEQ of PCDD and PCDF released per annum. The Stockholm convention requires the utilisation of toxicity equivalence factors which presently are the WHO-TEF. The UNEP toolkit states the difference between the I-TEF and WHO-TEF is minor and insignificant for the purpose of the Toolkit for estimating PCDD and PCDF emissions (UNEP, 2003).

### **i) Inventory Preparation Methodology**

This part describes the methodology applied throughout the various stages of this study in order to gather the needed information, compile obtained data, and overcome data limitations, and prepare the report. To commence data gathering, the identified list of contact individuals and organizations was put in place. This list was divided into two groups, the local authorities and private companies. The means of communication included the use of emails, faxes, and phone calls. This list of contacts gave two results, directly applicable information to the inventory and another set of contacts that represented a lower level of involvement.

Table 8 lists the source categories of the UNEP toolkit. The following sectors had to provide information for the purpose of the inventory (how many facilities were visited and contacted):

- Waste incineration
- Ferrous and non-ferrous metal production
- Power generation
- Mineral products
- Uncontrolled combustion Processes
- Production of chemicals and consumer goods

There are five steps included in the application of the UNEP Toolkit, and they are as follows;

1. Application of a screening matrix to identify main source categories
2. Checking of sub-categories to identify existing activities and source category in the country
3. Gathering of detailed information on the processes and classifying processes into similar groups by applying the Standard Questionnaire
4. Quantification of identified sources with default/measured emission factors.
5. Applying a nationwide to establish a full inventory, and report results using guidance given in the standard format.

The method used to compile this inventory follows the UNEP Toolkit guidelines and it was performed as follows.

- ◆ Dioxin emission sources to air, water and land were identified in accordance with the classification provided in the UNEP Toolkit.
- ◆ Dioxin emissions were estimated based on default UNEP emission factors and publicly available source activity.

The inventory included the following information;

- ◆ A listing of all process subcategories that are carried out in the country
- ◆ The activity statistics for each category and a short description of how this was found or estimated
- ◆ The range emission factors by process subcategory and the overall range of potential emissions
- ◆ More precise country estimates, where available, shown separately from the potential range of releases made using the UNEP Toolkit default emission factors, along with an explanation of how the results were achieved

This report presents the following information for each subcategory that is applicable to Botswana:

1. A brief description of the subcategory as it applies to Botswana
2. Available dioxin emission and subcategory activity data
3. An estimate of dioxin emissions in 2006 based on the UNEP Toolkit methodology and emission factors

**Table 8: UNEP categories and subcategories of dioxin emissions included in this inventory**

<b>Main Source Category</b>	<b>Sub-Category</b>
<b>Waste Incineration</b>	Medical/Hospital waste incineration
	Animal Carcasses burning
<b>Ferrous and non-ferrous metal production</b>	Foundries
	Copper production
	Thermal non-ferrous metal production ( for example <i>Nickel</i> )
<b>Power generation and heating / cooking</b>	Household heating and cooking - biomass
	Fossil fuel power plants
	Domestic heating- fossil fuels
<b>Production of mineral</b>	Brick

<b>Main Source Category</b>	<b>Sub-Category</b>
<b>products</b>	Asphalt mixing
<b>Transportation</b>	Petrol
	Diesel
	Heavy oil
<b>Uncontrolled combustion processes</b>	Fires/ burnings - biomass
	Fires, waste burning, landfill fires, industrial fires, accidental fires
<b>Production chemicals, consumer goods</b>	Textile plants
	Leather plants
<b>Miscellaneous</b>	Tobacco smoking
	Crematoria
<b>Disposal / Landfill</b>	sewage/sewage treatment
	Open water dumping
<b>Identification of potential hot Spots</b>	PCB containing equipment
	Dumps waste/residues from categories 1-9

### 2.3.4.3 Emission Estimations by Category

#### i) Waste Incineration

The following section presents the different surveyed categories together with the ones not been attended to, screening the existence of the covered categories in Botswana and their respective emissions of dioxins and furans in air, water, land, products and residues as estimated and their emission significance.

Waste incineration is the combustion of waste materials in a furnace and does not apply to open or domestic burning (UNEP, 2003). This category covers different levels of incineration, from organic, municipal, and hazardous to infectious waste. Incineration is a major source of dioxin and furan emissions release to the air. Some of the releases are produced within water and residues. Waste incineration is one major source of air pollution, therefore important features must be properly set during the design stage of an incinerator that affect the quality of release in air. This category is described by the following UNEP subcategories:

- Municipal solid waste incineration
- Hazardous waste incineration
- Medical waste incineration
- Light fraction shredder waste incineration
- Sewage sludge incineration
- Waste wood and waste biomass incineration
- Animal carcass

### **a) Municipal Solid Waste Incineration**

Municipal Solid Waste incineration is the combustion of municipal waste for the purpose of reducing the volume of municipal waste disposed in landfills. This is limited to domestic waste that is generated from residential areas which is mostly from organic and non-organic materials, and perceived as not hazardous. Municipal solid waste incineration is not practiced in Botswana hence this subcategory is not relevant to Botswana.

### **b) Hazardous Waste Incineration**

Hazardous waste incineration is the combustion of wastes and residues that contain hazardous material, not including hospital waste, which is treated in a separated section. This subcategory is also not applicable to Botswana.

### **c) Medical/Hospital Waste Incineration**

Medical waste incineration is the combustion of all wastes generated from medical activity including but not limited to hospitals, medical doctor, dentist or any other physician (UNEP, 2003). Incineration of medical waste is mainly concerned with infectious waste, and these are suspected to contain pathogens. A medical waste incinerator generally has two chambers for combustion, the primary chamber where waste is heated and volatilized and a secondary chamber where combustion is completed. Medical waste includes both infectious and non-infectious wastes. The types of materials burned at medical incinerators include<sup>19</sup>:

- Medical waste
- Pharmaceuticals
- Veterinary waste
- Crematorium waste
- Waste generated at research facilities

These medical wastes are typically incinerated for the following reasons (USEPA, 1998):

- To render the waste innocuous
- A reduction in the waste volume
- To reduce the mass of the waste

As for municipal waste incineration, the composition of medical waste can vary considerably resulting in highly variable emissions.

The three main types of medical waste incinerators are:

1. controlled-air incinerators
2. excess-air incinerators
3. rotary kiln incinerators

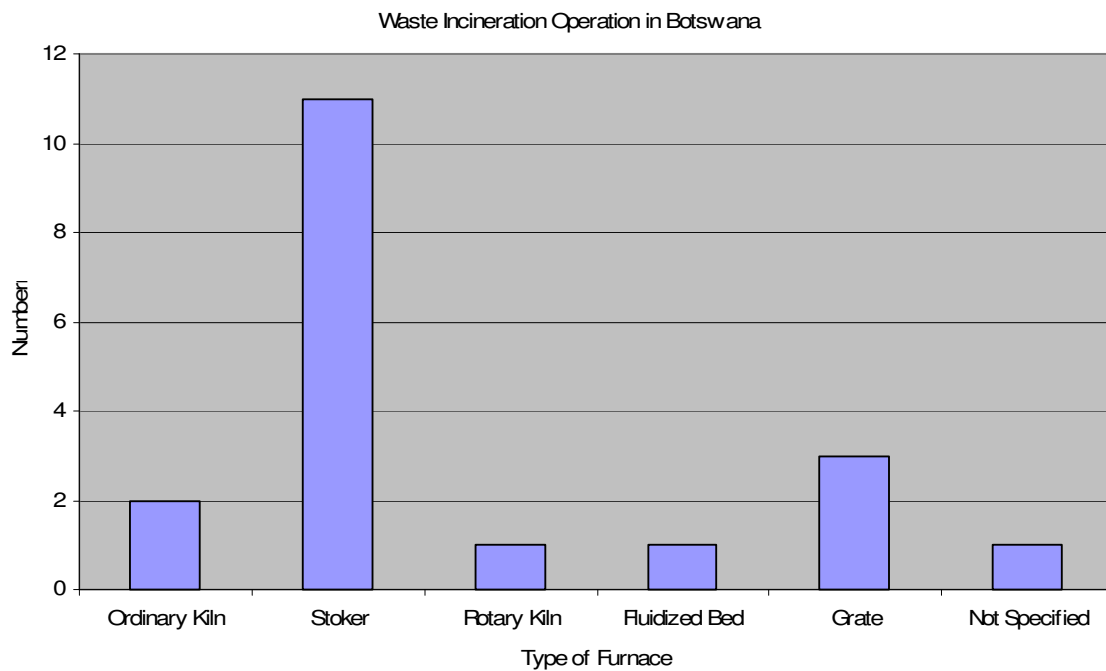
Table 9 elaborates on the medical incineration sector for Botswana.

### **Table 9: Identified medical incinerators operating in Botswana**

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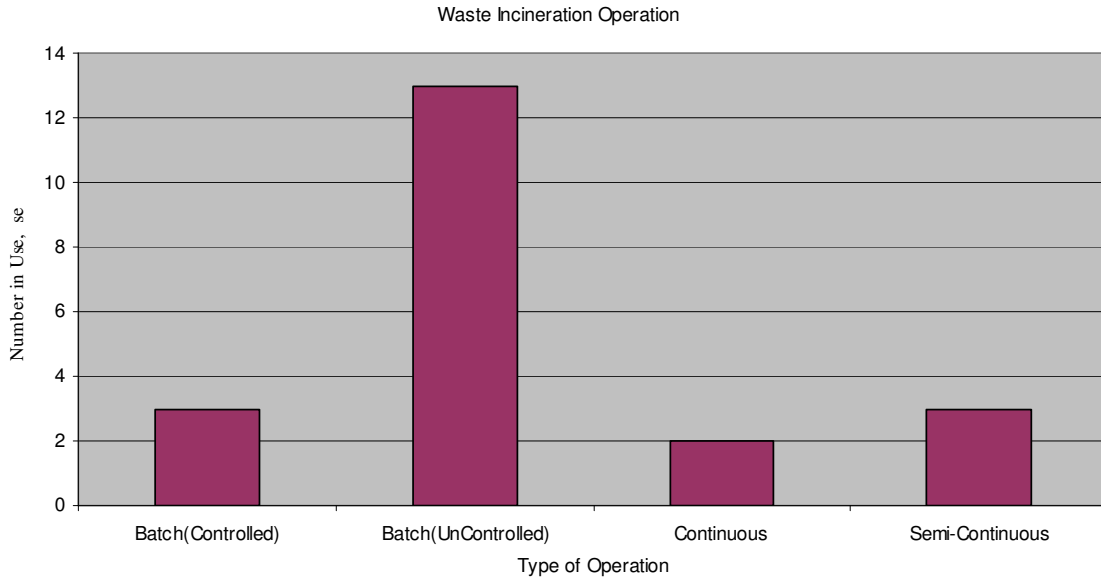
<sup>19</sup> United States Environmental Protection Agency, USEPA, (1998) The inventory of sources of dioxin in the United States, EPA/600/P-98/002Aa

Incinerator Description	Number operating in Botswana
Fluidized bed	1
Stoker	11
Rotary kiln ( Excess air/Batch type)	2
Grate ( Batch type)	3
Incinerator identified but no information available	2



**Figure 26: Number of Incinerators relative to the Type of furnace**

Figure 26 above shows that most incinerators in Botswana use stoker furnace seconded by grate and ordinary kiln. The operating pattern of the incinerators are provided in Figure 27



**Figure 27: Types of operation relative to the number of incineration**

The survey reveals that there is one major kind of incineration of waste existent in Botswana, which is the hospital waste incineration, and there are seventeen biomedical waste incinerators identified in Botswana. The type of operation that is commonly practiced at most incinerators is the batch (uncontrolled) (Table 10).

**Table 10: Number of Hospitals and correspondence to Risk Waste Incinerated**

Region	No of Hospitals	Hospital Risk Waste (Tons/year)	Incinerator description
Francistown	2	2280	Ordinary kiln
Ghanzi	2	3504.59	Stoker
North West	1	18.25	Stoker
Kgalagadi	4	1350.5	Grate
Sowa Township	1		(information not given)
Selebi Phikwe	1	10.73	Not specified
Jwaneng	1	3504	Grate
Southern	1	91.25	Stoker
Central	4	6347.7	Stoker
<b>Total</b>	<b>17</b>	<b>17851</b>	

**Table 11: Estimated PCDD/PCDF Emissions from Surveyed Hospitals**

Ref; #	Classes	Chamber type	Risk waste (t/a)	APCS Status	Emission factor (µg TEQ/t)	Annual Releases (g TEQ/a)	
						Air	Residue

H1	3	double	2190	good	525	920	1.150	2.015
H2	2	double	61.32	minimal	3000	20	0.184	0.032
H3	1	single	1095	absent	40,000	200	43.8	0.219
H4	4	double	3504	good	1	150	0.002	0.058
H5	1	single	10.73	absent	40,000	200	0.429	0.002
H6	3	double	608	good	525	920	0.018	0.126
H7	1	single	1095	absent	40,000	200	43.8	0.219
H8	4	double	3504	good	1	150	0.002	0.058
H9	2	single	2162	minimal	3,000	20	0.757	1.113
H10	1	single	11.73	absent	40,000	200	0.467	0.002
H11	1	single	3.28	absent	40,000	200	0.131	0.001
H12	2	single	127.75	absent	40,000	200	0.383	0.003
H13	1	single	1350.5	absent	40,000	200	54.02	0.27
H14	1	double	11.68	absent	40,000	200	0.467	0.002
H15	1	double	1350.5	absent	40,000	200	54.02	0.27
H16	1	double	18.25	absent	40,000	200	0.730	0.004
H17	–	–	–	–	–	–	–	–
<b>Total</b>	–	–	<b>17103.7</b>	–	–	–	<b>203.156</b>	<b>4.394</b>

Table 11 above provides a summary of the results from hospital waste incineration in the country. It was assumed that only risk waste is incinerated and only a fraction of it can not be incinerated like radioactive wastes and pressurised containers, is limited.

The data gathered from these hospital incinerators shows that more than half of all surveyed incinerators do not have air pollution control systems. An amount of 17103.7 tonnes of clinical/hospital waste was incinerated in 2006. Only two incinerators have a good class 4 air pollution control system status. Dioxins and furans from these hospitals is mainly released in the air with an amount of 203.156 g TEQ per annum and 4.394 g TEQ per annum in the residue

#### **d) Light Fraction Shredder Waste Incineration**

A mechanical way of separating waste that depends on weight difference between materials of ferrous metals is done as to fractionate the shredder aggregate into ferrous, non-ferrous and light weight aggregate fractions. In some cases, light fraction wastes are abstracted from shredders and combusted. Light fraction separation does not exist in Botswana hence this subcategory does not apply to Botswana.

#### **e) Sewage Sludge Incineration**

Sewage sludge is one of the end products of the wastewater treatment process. Dioxin and furans emissions are insoluble in water and get adsorbed to the solids present in wastewater. There are currently few wastewater treatment plants in Botswana, and the most common method of sewage sludge disposal in Botswana is to spread the sludge on land farming. Incineration of sludge is currently not carried out in Botswana.

#### **f) Waste Wood and Waste Biomass Incineration**

Waste wood and waste biomass incineration is the combustion of waste biomass under controlled conditions that may have been treated or mixed with treated or contaminated biomass. No information on combustion of contaminated wood is available in Botswana.

#### **g) Animal Carcass Incineration**

Dioxins and furans are mainly released in the atmosphere due to burning of animal carcasses in low technology furnaces. Bones and remains from animals are mainly deposited in landfills. In

Botswana, at present the incineration of animal carcass is done mainly in Lobatse and Francistown abettors for condemned meat or animals. The total amount incinerated in 2006, was 1095 tonnes and it released an amount of 0.548 g TEQ/a of dioxins and furans to air with an insignificant amount of residues (Table 12).

**Table 12: Dioxin and furan emissions from Animal Carcass Incineration**

Incinerator description	Waste burned (t/a)	Emission factor ( $\mu\text{g TEQ/t}$ )	Releases to Air (g TEQ/a)
Uncontrolled Batch Combustion (no APCS)	1095	500	0.548

Dioxin and furan releases from animal carcass incineration are released to air medium only.

## ii) Ferrous and Non-ferrous Metal Production

This category concerns the recovery of metals from ore and or scrap. Primary metal production is considered to be those processes that obtain metal for original ore and secondary metal productions are those operations that obtain a refined metal from scrap (UNEP, 2003). In this category, products that are mainly considered as potential sources of dioxin and furans emissions in air and residue. UNEP Toolkit has divided Ferrous and non-ferrous metal production in the following categories:

- Metal ore sintering
- Coke production
- Iron and steel production
- Copper production
- Aluminium m production
- Lead production
- Zinc production
- Brass and bronze production
- Magnesium production
- Other non-ferrous metal production

### a) Metal Ore Sintering

Sintering process is the pre-treatment step where fine particles of metal ores are agglomerated by combustion. The raw materials are mixed with water to provide a cohesive matrix, and then placed on a sinter strand. Dioxins and furans are mainly emitted in the air due to burning of the process. Nevertheless, iron manufacturing is not performed in Botswana

### b) Coke Production

Coke production is mainly done from hard coal or brown coal by carbonisation. This occurs in coke ovens by exposing the coking coal to high temperatures in the absence of air. Most dioxin and furan emissions are released in the air and some in the water due to quenching. This subcategory is not applicable to Botswana since this country does not produce coke.

### c) Iron and Steel Production

Dioxins and furans are mainly emitted in the air from four main processes at the steel production plants. The four routes are commonly used for the production of steel are; the classic blast

furnace, which is the basic oxygen furnace route, direct melting of scrap, smelting reduction and direct reduction. Dioxins and furans emissions depend on the input material quality, furnace type, filter system and the rate of production for liquid steel. Steel production is not performed in Botswana.

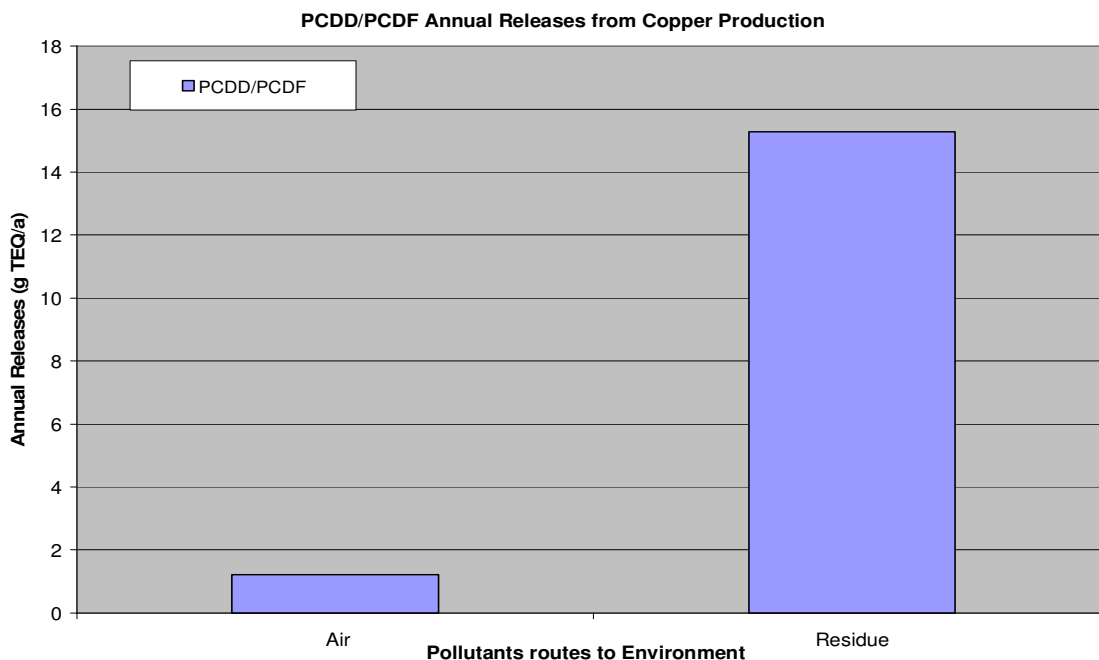
#### d) Copper Production

This part covers both the primary and secondary production of copper. Primary copper production is mainly produced from primary concentrates and other materials either by pyro-metallurgical or hydrometallurgical routes (UNEP, 2003). Hydrometallurgical methods depend on leaching, solvent extraction and below 50 °C and not expected to emit dioxin and furans. Pyrometallurgical process depends on roasting, smelting, converting, and refining, and electro-refining. The occurrence of dioxin emissions is mainly associated with the secondary copper production due to the presence of contaminants in the feedstock (UNEP, 2003). Copper concentrates from mining operations can be smelted using various methods to convert the concentrates to copper metal. Botswana is producing copper matte by melting the copper concentrate with fluxes in a furnace that is poured with an oxygen enriched environment, causing sulphur fraction of copper sulphides to burn and become sulphur dioxide leaving behind blister copper.

To fill the data required to calculate the dioxins and furans emissions, the following options were supplied by the toolkit; type of production of copper (primary or secondary), the process technology, and the air pollution control system. According to the survey carried out on copper production, it was found that there is only one industry for copper (secondary) production performed in Botswana.

**Table 13: PCDD/PCDF Annual Releases from Copper Production**

Class #	APC System	Production Rate (T/year)	Emission Factors (µg TEQ/t)		Annual Releases (g TEQ/ year)	
			Air	Residue	Air	Residue
2	Well controlled	24 255	50	630	1.213	15.281



**Figure 28: PCDD/PCDF Annual Releases from Copper Production**

Copper production emissions results are summarised in Table 13 and Figure 28 above. Copper production from the surveyed industry resulted in an annual production of 24 255 tonnes. Dioxins and furans resulting from this production had annual releases of 1.213 g TEQ/a in the air and 15.281 g TEQ/a in the residue. This shows that copper production releases of dioxins and furans more in residue than in air.

#### **e) Aluminium Production**

Primary aluminium is produced where aluminium ore is refined into aluminium oxide trihydrate and then electronically reduced into metallic aluminium. Dioxin emissions have been associated with the use of carbon anodes at primary aluminium production facilities. Secondary production of aluminium is conducted by smelting aluminium scrap in a variety of furnaces. Dioxin and furans release is mainly related to the production of secondary aluminium from scrap material. Factors affecting the release of dioxin and furans depend on the nature of scrap, its thermal pre-treatment, and melting and air pollution control system in use (UNEP, 2003). Aluminium production is another metal production Botswana does not produce, all Botswana aluminium scrap is exported to South Africa.

#### **f) Lead Production**

Lead is mainly produced in a primary or secondary process from used material. Emissions of dioxins and furans from direct smelting are low. These emissions are mainly formed when lead forms a secondary production from scrap material containing chlorinated organic material. Lead is mainly collected from the recycling of car lead-acid batteries, after which the batteries are melted and lead is subsequently recovered and manufactured into lead ingots. In Botswana there is one known factory that collects lead-acid batteries, and these are transported to South Africa for recycling to produce lead, unfortunately Botswana does not produce lead.

### g) Zinc Production

Zinc may be recovered from a variety of processes. A variety of scrap material may be used for zinc recovery in a rotary kiln. Processing of impure scrap such as non-metallic fraction from shredders is likely to involve the production of dioxins and furans. Nevertheless, zinc is not currently produced in Botswana.

### h) Magnesium Production

The production of magnesium from ores is based on the electrolysis of  $MgCl_2$  or the chemical reduction of oxidised magnesium compounds. The raw materials used are dolomite, magnesite, carnalite, or seawater. Heating of magnesium in the presence of  $Cl_2$  is a major source of dioxins and furans. The production of magnesium is not performed in Botswana.

### i) Other Non-Ferrous Metal Production

The processing and refining of thermal non-ferrous metals such as tin and nickel can lead to the production of dioxins and furans. Dioxin and furan concentration are affected by the degree of treatment of the scrap material and the flue gases. Although there is one industry producing nickel in Botswana, its products are processed in Selibe-Phikwe, BCL.

The total release of this sub sector is provided in Table 14.

**Table 14: PCDD/PCDF Emissions from Category 2 (ferrous and Non-ferrous metal Production)**

Production type	Number of Industries	Production Rate (t/a)	Emission Factor Air ( $\mu g$ TEQ/t)	Annual Releases Air (g TEQ/a)
Thermal non-ferrous metal production	1	26 762	100	2.426

### iii) Power Generation and Heating

This category includes major sources of power generation, such as power stations, industrial firing like furnaces, biogas combustion including of landfills, and biomass use for power generation.

Sub-categories covered in Botswana are:

- Fossil fuel power plants
- Biomass power plants

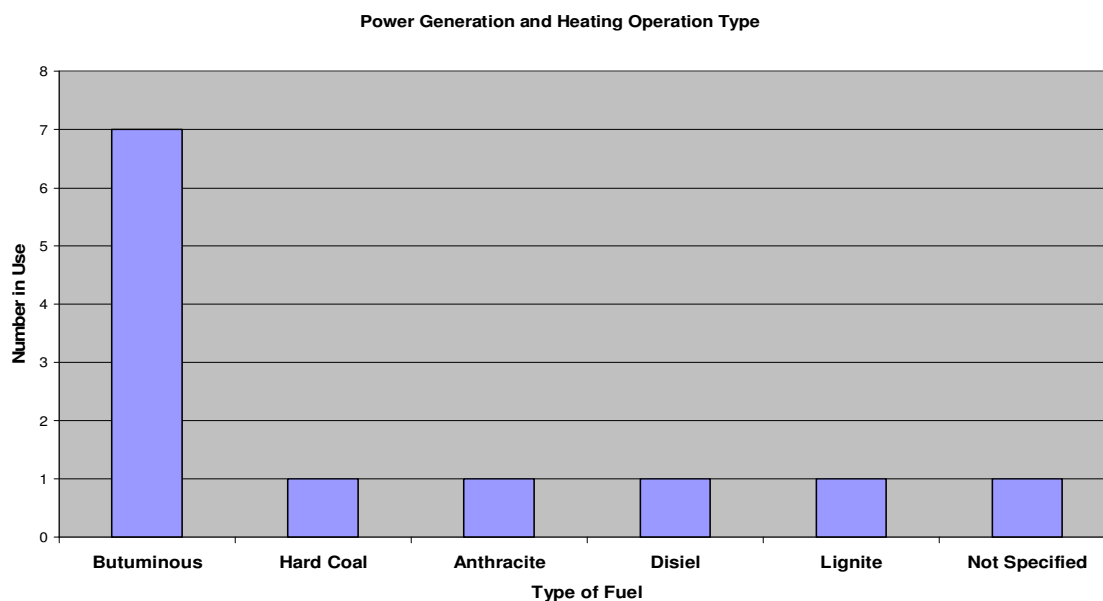
#### a) Fossil Fuel Power Plants

Fossil fuel power plants are widely used for the generation of electricity and also fuel usage in boilers for industrial heating and processing. Four types of fossil fuel are considered; coal, heavy fuel oil, light fuel oil and natural gas. Dioxin and furan is mainly released in the air and in the residue after the combustion process is completed and the flue gas cools down. The calculation of dioxin and furan release depends on the type of fuel burned and its quantity. Data concerning coal

consumption for the purpose of electricity generation in Botswana was obtained through the use of the UNEP Toolkit questionnaire from BPC and Botswana Ash (Botash) (Table 15).

**Table 15: Fuel consumption relative to operation type**

Area	Coal/Fuel Used	Type of Operation
Shoshong SSS	Butuminous Coal	Continuous
Denisti Textiles	Hard Coal	Batch
BPC	Butuminous Coal	Continuous
Ghanzi Hospital	Disiel	Batch
Microlith	Butuminous Coal	Semi-Continuous
Botash	Butuminous Coal	Continuous
Breweries Palapye	Butuminous Coal	batch
Breweries F/town	Anthracite	Batch
BMC F/town	Not speccified	Semi-Continuous
Nertex F/town	Butuminous Coal	Continuous
Mupane	Not specified	Not Specified
Nyangangwe Hospital	Butuminous Coal	Semi-Continuous
Serowe College	Lignite	Continuous



**Figure 29: Power Generation and Heating operations relative to Fuel Used**

Botswana dioxins and furans data were submitted by different sectors, six for fossil fuelled power plants burning bituminous coal and three plants burning brown coal. Figure 29 above shows that most sectors use bituminous coal, and most of these are for coal fired boilers.

**Table 16: PCDD / PCDF releases from fuel Consumption**

Fuel type	Class No	Fossil fuel (tj/a)	Emission factor (Air) (µg TEQ/t)	Annual Release (Air) (g TEQ/a)

Bituminous	2	161,783	10	1.618
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Table 16 shows an estimate of a total of 1.618 g TEQ/a of dioxins and furans released in the air from the burning fossil fuel for power generation.

#### b) Biomass Power Plants

Biomass power plants rely on the combustion of biomass for power and heating production. The bio-fuel can include twigs, bark, saw dust, wood shavings, and agricultural residues, among others. Such power generation methods are not employed in Botswana.

#### c) Landfill and Biogas Combustion

Anaerobic decomposition of solid waste leads to the generation of landfill biogas. This gas can be collected, treated and used for power generation. A large amount of this gas is composed of methane, carbon monoxide, carbon dioxide and ammonia. Dioxin and furan emissions are mainly generated in the air when the biogas is in a flare, in turbines or other power generating devices. Even though there are eight landfills in Botswana, biogas is not being managed.

#### d) Household Heating and Cooking Biomass

This subcategory covers all residential heating and cooking using coal, oil and natural gas as fuel. Information on the domestic consumption of fossil fuels in Botswana was obtained from central statistics office, and the study shows that household heating and cooking releases an amount of 6.259 g TEQ per annum of dioxins and furans to air.

Lack of directly available relevant data necessitated the use of population growth for the assessment of the estimation of the household heating and cooking biomass. The 2001 population statistics was used to estimate the population in 2006. This population number is then multiplied by the biomass consumed per person per year to obtain the total annual biomass. The amount of biomass in 2006 was estimated to 62 588 tonnes used for cooking (Table 17).

**Table 17: Household and Cooking Biomass Calculations**

Parameter	Value	Parameter	Value
Population (2001)	1 557 010	Population (2006)	1 512 012
Annual Biomass per person (2001)	0.04139 tons/person/yr	Annual Biomass per person (2006) <sup>2</sup>	0.04139 tons/person/yr
Total Annual Biomass Burnt (2001)	64 445 tons/yr	Total Annual Biomass Burnt (2006)	62 588

Table 17 above presents the calculations for the amount of biomass burned for household and cooking. According to the (UNEP, 2003) emissions toolkit, the total releases of dioxins and furans for 2006 is 6.259 g TEQ/a in the air and 1.300 g TEQ/a of dioxins and furans in the residue.

#### iv) Production of Mineral Products

This section details dioxin and furan releases from the production of mineral products. The following subcategories have been identified as possible sources of dioxin and furan emissions even though some of them are not applicable to Botswana.

- Cement production
- Lime production
- Brick Production
- Glass production
- Ceramics
- Asphalt mixing

#### **a) Cement Production**

This sub category is about the emission of dioxin and furan from production of cement and it is among the subcategories not under taken in Botswana, and only cement packing is done.

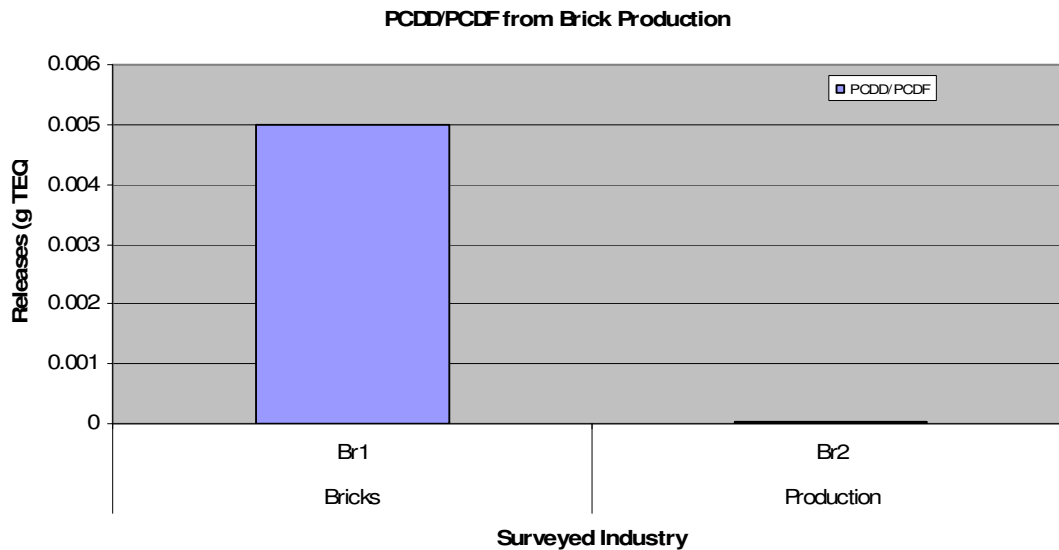
#### **b) Lime Production**

Lime is produced in a more or less the same manner as cement. The most significant difference is that the main raw material is limestone only. This subcategory is also not relevant to Botswana.

#### **c) Brick Production**

Bricks are made from a wide range of clays and shales with a very fine particle size at high temperatures between 1,000 to 1,200 °C to achieve the desired porosity. Dioxins and Furans are mainly emitted in the air. The presence of a dust collection system and its efficiency in dust removal affects the concentration of the pollutants released in the air. In Botswana there are only two factories where bricks are produced. Types of kiln used in Botswana are mostly fuelled by coal and diesel, and these are the Tunnel furnace kiln. These kilns are continuously fired and bricks are then moved on trolleys through the kiln.

Two factories were identified to be dealing with bricks in Botswana, to collect the required data on the production of bricks and the status of air pollution control systems, one factory was visited and the other sent the information by fax. The total production of bricks was found to be around 25030 tonnes a year with an annual release of dioxins and furans of 0.5006 g TEQ/a in the air. These results are illustrated in Figure 30 below.



**Figure 30: PCDD/PCDF Annual Releases to Air from Brick Production**

**d) Glass Production**

Glass traditionally is manufactured from sand, limestone, dolomite and soda and a number of other materials may be added to provide colour, clarity and purification. Glass manufacturing is achieved in furnaces under high temperatures. The main factor that affects the emissions of dioxins and furans is the presence of a dust collection system. These pollutants are mainly emitted in the air from glass production. This subcategory falls under a number of which are not applicable to Botswana.

**e) Ceramics Production**

Ceramics are heat resistant materials generated by high heats in furnaces. There are two common basic raw ingredients namely, kaolinite and montmorillonite. Although there is not enough information yet to consider the production of ceramics as a source of dioxin and furan formation, the similarity in process to brick production and the high temperatures involved has resulted in this subcategory being included in the inventory (UNEP, 2003). Ceramics production is also not applicable to this country since Botswana does not produce ceramics.

**f) Asphalt Production**

Asphalt consists of two raw materials. These are bitumen, which is a thick tarry substance, and an aggregate, normally from gravel of different grades. The process of asphalt mixing involves heating and drying of these aggregates using temperatures between 160 – 175 °C. This bitumen is then applied while aggregate is still hot. This usually takes place in the same heating chamber as the one used for heating the aggregate. The release of dioxins and furans in the air and residues depends on the gas filter system available at the mixer. There is only one asphalt mixing plant identified in the country with a production rate of 10980 tonnes per annum. The activity results in an annual release of dioxin and furan emissions of 0.001 g TEQ/a to the air (Table 18).

**Table 18: PCDD/PCDF Annual Releases to Air from Asphalt Mixing**

Name	APC System	Production Rate ( t/a)	Emission Factor (Air) ( $\mu\text{g TEQ/t}$ )	Annual Releases (Air) (g TEQ/a)
Asphalt Botswana (Asphalt mixing Industrial facility)	None	10980	0.07	0.001

## V Transportation

This category covers emissions from fuel combustion during transportation. Transport has been broken down into the following categories;

- 4 stroke engines (Petrol)
- 2 stroke engines (petrol)
- Diesel engines
- Heavy oil fired engines

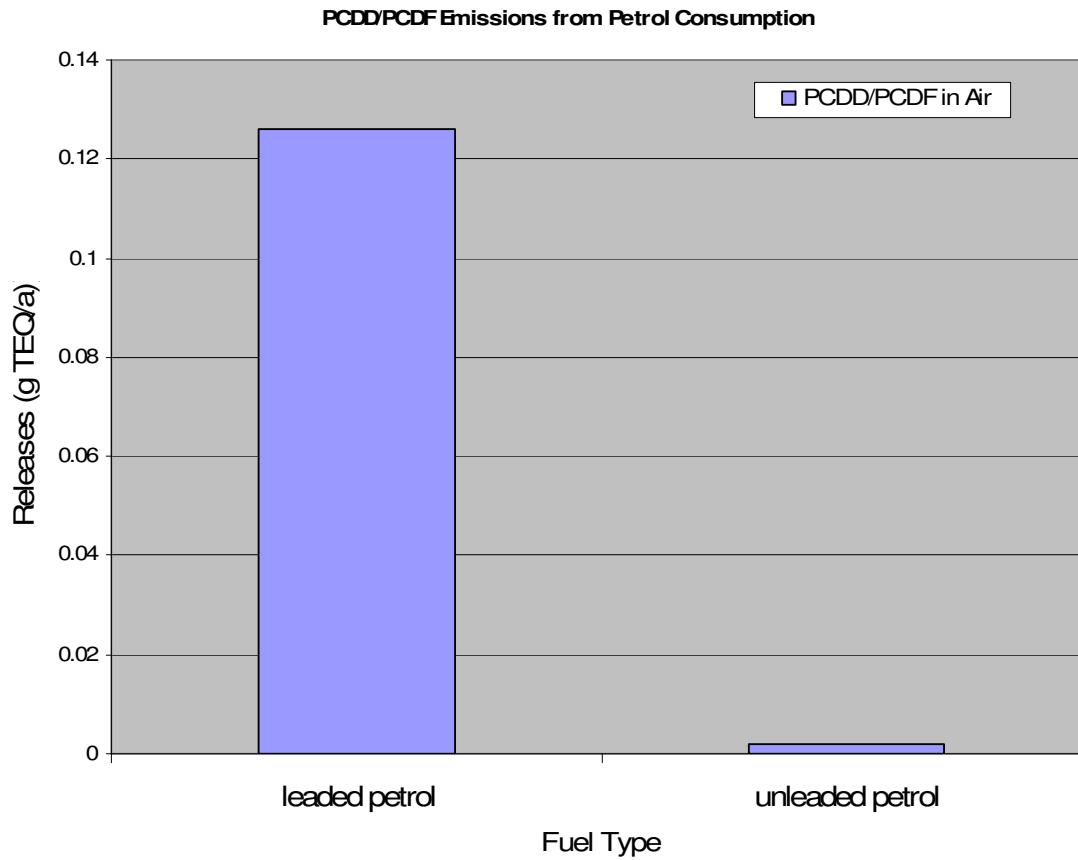
### a) Four-Stroke Engines (Petrol)

4-stroke engines are commonly used in passenger cars and in medium and large engine capacity motorcycles. In Botswana petrol usage in this context refers to both four and two stroke engines use the same gasoline. The process of phasing out the use of unleaded gasoline in Botswana has led to a significant reduction in usage of this fuel in both two and four stroke engines (Table 19).

**Table 19: Imported Unleaded Gasoline (Botswana Customs, 2006)**

Type of Fuel	Amount Imported (Tons)	Percentage (%)	Release (Air) (g TEQ/a)
Leaded Petrol	57 291	75	0.126
Unleaded Petrol	19 097	25	0.002
Total	76 388	100	0.128

The total estimated consumption of fuel used by both two and four stroke engines in 206 amounts to 76 388 tonnes per annum. This consumption leads to an annual releases of 0.128 g TEQ/a of dioxins and furans in the air (Figure 31).



**Figure 31: PCDD/PCDF Releases from Petrol Consumption**

**b) Two-Stroke Engines (petrol)**

2-stroke petrol powered internal combustion engines are commonly used in small, motorcycles, lawnmowers, and other small machinery. These are covered under four stroke engines since they both use the same gasoline.

**c) Diesel Engines**

Diesel engines are commonly used in heavy trucks, light trucks, buses, heavy construction equipment, and a smaller proportion of passenger cars in Botswana. The one class of emission factor for this subcategory is air emissions; it gives releases of 0.005 g TEQ per annum.

**d) Oil Fired Engines**

Heavy fuel oil is commonly used for transportation in ships and for the heating of organic liquid storage tanks and stationary power generations. In Botswana these are used in tanks and other large motors used in mining industries. Fuel consumption amounting to 1392 tonnes per year released 0.006 g TEQ/a.

**vi) Uncontrolled Combustion Processes**

This category covers uncontrolled combustion processes such as harvest burning, forest fires, and bush or grassland burning. What characterises these processes is their occurrence in open air; they also include landfill and waste fires. Uncontrolled combustion is divided into the following subcategories

- Biomass burning
- Waste burning and accidental fires

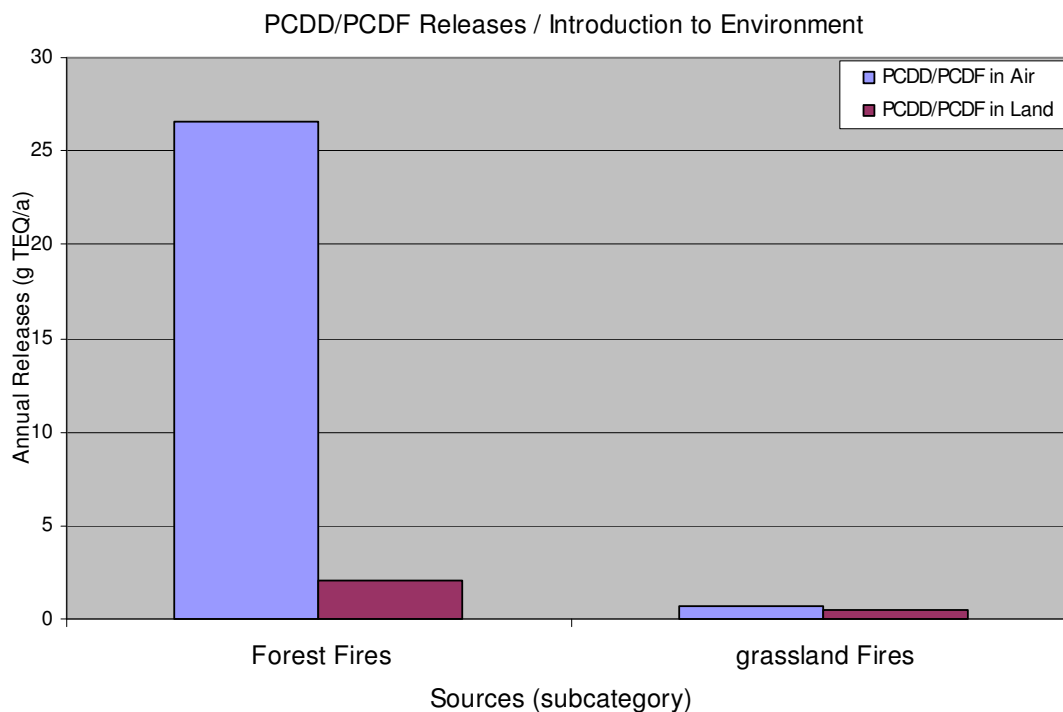
**a) Biomass Burning**

This subcategory covers the burning of biomass occurring in open, and these include forest fires, whether intentional or accidental as well as burning of grassland and harvest residues in agricultural fields. The release of dioxin and furans from biomass burning is related to the amount of material burned. Concerning forest and grassland burning, an approximate data was received from Forestry department. The data provided by the forestry department office was only for forest fires and grassland fires, and there was no data for Agricultural residue burning (in field), and these fires contributed to releases of 26.627 g TEQ per annum.

Table 20 and Figure 32 below presents an overall releases of dioxins and furans from this subcategory and these are estimated at 27.278 g TEQ/a in the air and 2.599 g TEQ/a in the land. Quite a significant amount of these pollutants are released to air are from forest fires and this is because large amount of area was burnt in 2006.

**Table 20: Dioxin and Furans Releases from Biomass Burning**

Name	Area (ha)	Biomass burnt (tons/ha)	Biomass burnt ( tons)	Emission Factors(µg TEQ/t)		Annual Releases (g TEQ/a)	
				Air	Land	Air	Land
Forest fires	519520.1	10	51952001	5	4	26.627	2.078
Grassland fires	52100	2.5	130250	5	4	0.651	0.521
<b>Total</b>						<b>27.278</b>	<b>2.599</b>



**Figure 32: Dioxins & furans Releases from Uncontrolled Combustion Processes**

**b) Waste Burning and Accidental Fires**

This subcategory includes landfill fires, accidental fires in houses and factories, uncontrolled domestic waste burning, accidental fires in vehicles and open burning of wood especially during construction. It is suggested that on average, forest fires ranges from an area of a hectare and greater, where as bush burning which is common along the main roads from the clearing of vegetation along these roads in Botswana is estimated to cover an area of 50 square meters for small fires, and medium fires covers an area of around 500 square meters.

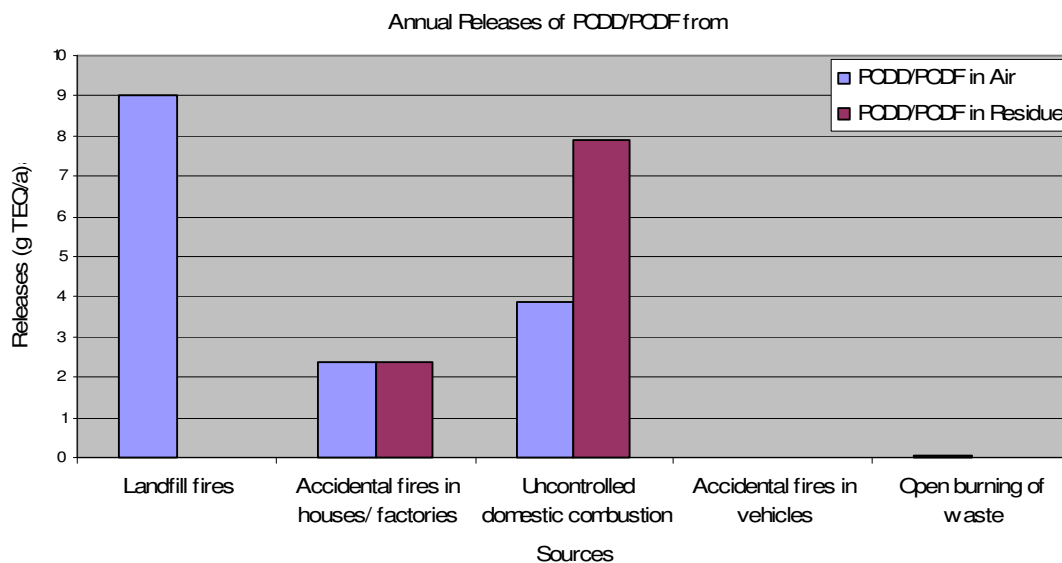
Data needed for this category are the number of accidents events per category and quantity of material burned. Fire Brigade department provided data in the form of the number of events per types of fire accidents. The number of events of accidental fires in houses and factories reported in 2006 by the Fire Brigade as 115 houses and 6 factories fires (Table 21).

Figure 33 below shows that uncontrolled domestic waste burning plays a significant role in the releases of these persistent organic pollutants to air, followed by dumping sites and landfill fires.

**Table 21: PCDD & PCDF Emissions Estimations from waste burning and Accidental fires**

Name	Biomass Burnt (event)	Emission Factor Air (µg TEQ/t)	Annual Releases Air (g TEQ/a)	Emission Factor Residue (µg TEQ/t)	Annual Releases (g TEQ/a)
Landfill fires	31	1000	9.00	-	0

Name	Biomass Burnt (event)	Emission Factor Air (µg TEQ/t)	Annual Releases Air (g TEQ/a)	Emission Factor Residue (µg TEQ/t)	Annual Releases (g TEQ/a)
Accidental fires in houses/ factories	121	400	2.4	400	2.4
Uncontrolled domestic combustion	102	300	3.9	600	7.9
Accidental fires in vehicles	28	94	0.004	18	0.001
Open burning of waste	79	60	0.042	10	0.007



**Figure 33: PCDD/PCDF Emissions Estimates from Waste Burning & Accidental fires**

The total emissions of dioxins and furans from this subcategory are 15.346 g TEQ/a released in the air and 10.308 g TEQ/a dioxins and furans released in the residue. Table 18 and Figure 9 above give a summary of the results from this subcategory.

**vii) Production of Chemicals and Consumer Goods**

The production of chemicals is considered as one of the major source of dioxins and furans within several type of production. Dioxin and furan is released into the air, water, products, and residue

as a result of the manufacturing of different chemical products. Production and use of chemicals and consumer goods has been broken into the following categories;

- Pulp and paper production
- Chemical industry
- Petroleum industry
- Textile production
- Leather refining

**a) Pulp and Paper Production**

Pulp and paper production is not carried out in Botswana.

**b) Chemical Industry**

There are no chemical industries in Botswana, as we are currently importing all of our chemicals.

**c) Petroleum Industry**

Crude oil is refined depending on the properties of crude oil to be refined and the desired products. According to the UNEP, there is only one potential source of dioxin and furan within the refining industry; the re-generation of the catalyst used during catalytic cracking of the larger molecules into smaller ones. In Botswana there are no petroleum refineries as the country imports all of its petroleum.

**d) Textile Production**

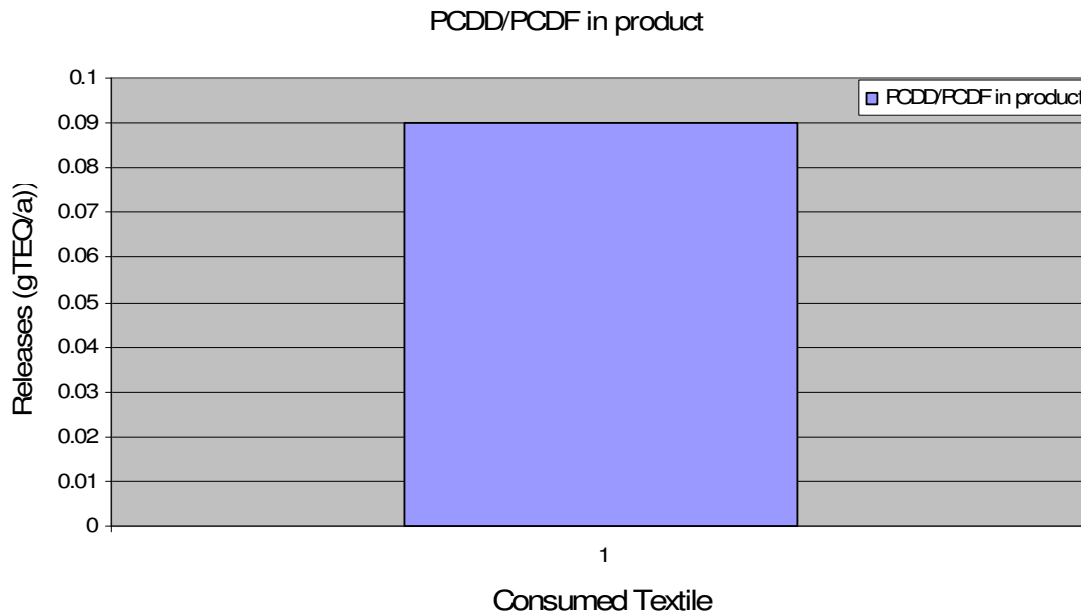
The textile production includes a diverse range of process textile-related products. These include fibre, or further processing of finish goods. The textile production is a potential source of dioxin and furans in the product mainly due to the following process actions

- PCDD/PCDF contamination in the raw plant due to the use of pesticides such as pentachlorophenol
- Use of chemicals at the washing stage that might be contaminated with PCDD/PCDF

**Table 22: PCDD/PCDF Releases from Import and production of Textile**

<b>Import (t/a)</b>	<b>Production (t/a)</b>	<b>Inland (t/a)</b>	<b>Emission Factor Product (µg TEQ/t)</b>	<b>Annual Releases (g TEQ/a)</b>
528.941	360.721	899.662	100	0.09

The concentration of dioxins and furans for textiles accounts for textile consumed in the country. Inland consumption of 899.662 t/a gave an annual release in product of dioxins and furans of 0.09 g TEQ/a. and these results are summarised in Table 22 above and Figure 34 below.



**Figure 34: PCDD/PCDF Annual Releases from Textile Products**

**e) Leather Refining**

Dioxin and furan production has been assumed to be in the product due to PCP applications to leather. In Botswana, there is only one known tannery, Lobatse tannery which depends on cows slaughtered at the Lobatse-Botswana Meat Commission. Although this is the case, this subcategory does not play much part in release of dioxin and furans in these three media, as it releases 0.002 g TEQ per annum of dioxins and furans in product.

**viii) Miscellaneous**

Miscellaneous is used to quantify all emission sources that do not fit into any of the categories described above. The following categories are not included in the miscellaneous category;

- Drying of biomass
- Crematoria
- Smoke Houses
- Dry cleaning
- Tobacco smoking

**a) Drying of Biomass**

The UNEP Toolkit indicates that dioxin emissions can occur from the drying of biomass if contaminated wood is used as fuel. The drying of biomass using combustion does not take place in Botswana. Therefore, dioxin emissions from drying of biomass are taken to be not applicable in Botswana.

**b) Crematoria**

Crematoria are used to reduce human bodies to ash for the purpose of burial. The corpse is placed in the combustion chamber within its coffin. These are typically fired by natural gas. Material

induced within the coffin wood could affect on increasing emissions of dioxins and furans during the burning process. This is not a common practice in Botswana, as human bodies are usually buried in cemeteries there are just a few crematories in the country. One crematorium provided the data for the inventory, and the burning process is done using an incinerator as a treatment method.

### **c) Smoke Houses**

Smoke houses use the combustion of biomass to produce smoke in a closed chamber to preserve food. These are small installations that do not reach optimal combustion. Dioxin and furans emissions are mainly to the air from the combustion products of biomass and to land from ash disposal are possible. There are currently no smoke houses in Botswana.

### **d) Dry Cleaning**

It has been shown that dioxin and furan is concentrated in the distillation residues from cleaning of textiles with solvents. Textiles contaminated with dioxin and furans lead to the contamination of residues due to the preservation of textiles and colouration by the use of chemicals and dyestuff. When the solvent is distilled for recovery, residues get concentrated and further disposed.

### **e) Tobacco Smoking**

Smoking of tobacco is considered to be a thermal process where gases are emitted. Dioxin and furan emissions are higher for cigars, where the tobacco in one cigar is equivalent to 2 to 20 times the amount of tobacco in a cigarette (UNEP, 2003). The information concerning cigarette consumption in Botswana was obtained from Trade Statistics office.

### **f) Disposal / Landfilling**

This section covers dioxin emissions from waste disposal to land and water, thus non-thermal waste management. The section is also linked to all the categories through the residues, which usually end up in the waste landfill. The following subcategories are included in this category;

- Landfills and waste dumps
- Sewage and Sewage treatment
- Open water dumping
- Composting
- Waste oil disposal

#### **a) Landfills and Waste Dumps**

Landfills and waste dumps cover all areas where waste has been buried, disposed of, or piled at the surface. Leachate is produced from the degradation of organic matter in a landfill. This liquid percolates through the waste and it can lead to surface and underground pollution when control and treatment methods are not in place. Dioxin and furans are mainly released into the water from leachate discharge. The type of waste dumped in the landfill has effects on the level of concentration of production of dioxin and furans. Leachate collection and treatment is not yet carried out in Botswana unless on sample analysis for experimental purposes.

#### **b) Sewage and Sewage Treatment**

Sewage in this case is the wastewater arising from human sanitation and any associated industrial wastes that are treated in the same systems. Sludge describes the solid component of the wastewater that is often extracted during the sewage treatment process. The sources of wastewater greatly affect its dioxins content, generally increasing with the increase in industrial processes discharge into the sewer system. With more advanced processes where sludge production is higher, dioxin and furan compounds are more likely to concentrate in the sludge. The information on the amount of sludge generation was obtained at the treatment plants, and it was found that releases to water is 0.001 g TEQ per annum where as residue released is 2.336 g TEQ per annum.

### **c) Open Water Dumping**

This subcategory relates to discharges from households, offices and other small business as well as run-off from contained land such as parking lots (UNEP, 2003). Open water dumping is becoming a common practice in Botswana even though this subcategory an estimate of the number of households which are not connected to the sewer system was done with the help of the information obtained from the Central Statistics Office. From the value derived, the amount of wastewater dumped was computed and it was found that this subcategory releases 0.045 g TEQ per annum of dioxins and furans to water.

### **d) Composting**

Composting is a popular method of disposal for wastes originating from kitchen activities, gardening, and parking and other public or private area maintenance, agriculture and forestry. Basically, any organic material can be composted and this disposal process generally has a high degree of acceptance by public. The composting process results in a loss of about 50% of the weight basis of the input material (UNEP, 2003). There is currently no data about composting in Botswana.

### **e) Waste Oil Disposal (non-thermal)**

This section covers the disposal of waste oil that is not covered under transformers containing PCBs which are dealt with under reservoirs. Waste oil in Botswana is normally collected and sent to South Africa for recycling, therefore this subcategory is not relevant to Botswana.

## **2.3.4.4 Comparative Analysis**

This section aims at presenting a summary and a comparison of subcategories within each category.

### **Emissions Contributed by Category**

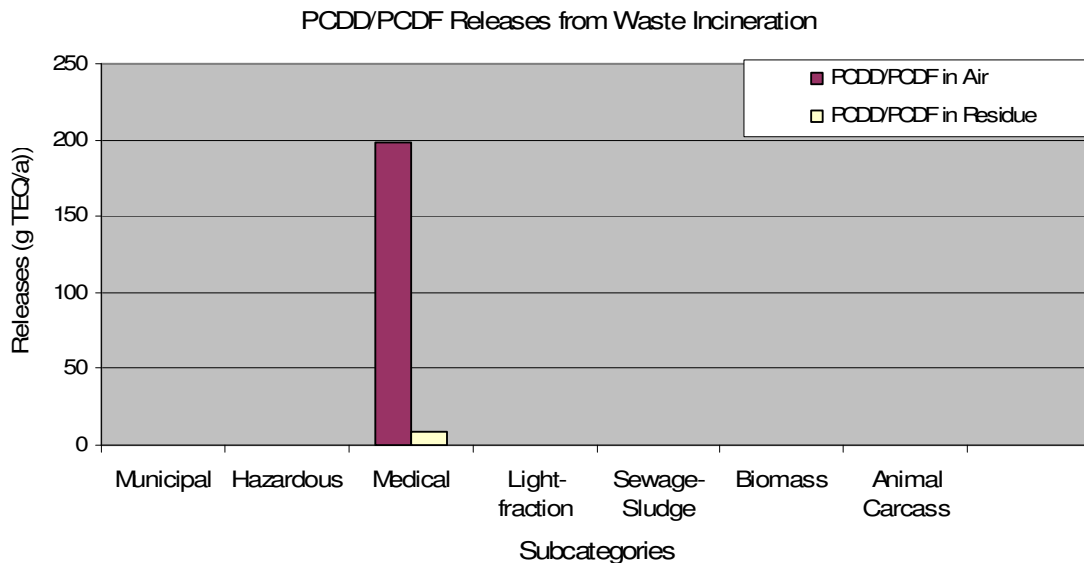
This section focuses on comparing dioxins and furans emissions within subcategories of each category. It highlights minimum and maximum levels of dioxins and furans according to their sources.

### **Waste Incineration**

This category covers seven types of incineration of waste products. Dioxin and furan emissions are released in the flue gas especially in the cooling stage. These pollutants are also expected in the residue formed in the bottom ash. Chlorine content is an important parameter that affects the concentration of dioxins and furans released. There are only two kinds of waste incineration

existent in Botswana, and these are hospital/medical waste incineration and animal carcass incineration.

Emission results from waste incineration are illustrated in Figure 35 below. From this category, hospital/medical waste incineration releases a significant amount of dioxins and furans in the air and in the residue respectively as compared to animal carcass incineration.



**Figure 35: PCDD & PCDF Releases from Waste Incineration**

### Ferrous and Non-ferrous production

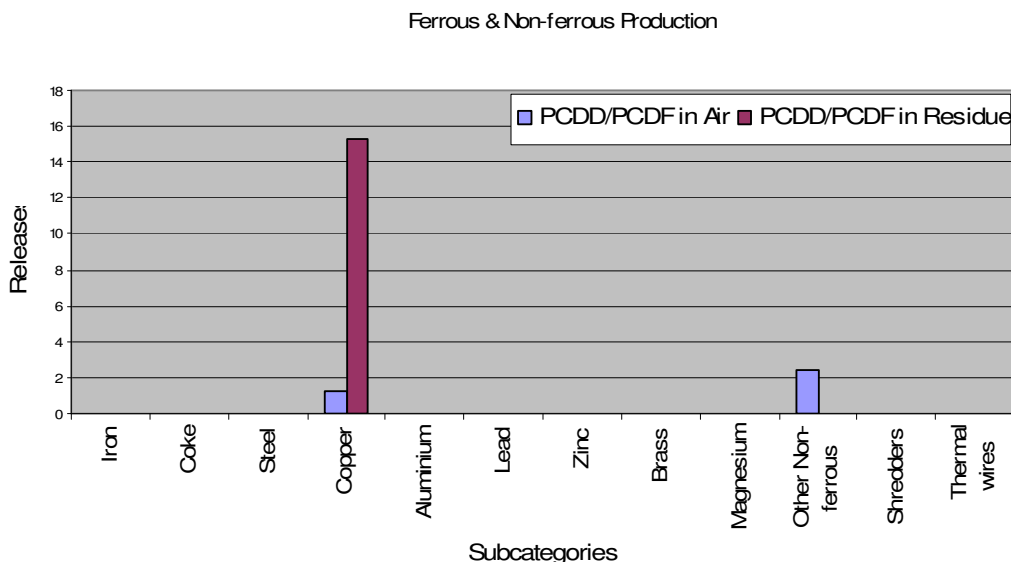
Major emissions from ferrous and non-ferrous production are emitted from primary processes starting with ores and concentrates. Materials produced from reuse and recycle of scrap products emit dioxins and furans in the air and residue. The concentration of emitted dioxins and furans is dependent on the quality of the input material, the furnace temperature and the air pollution control system.

Emission results from ferrous and non-ferrous industries are presented in Table 23 and Figure 36 below. From this category, copper production releases more dioxins and furans emissions in the residues than other subcategories and releases of dioxins and furans in the air are contributed significantly by thermal non-ferrous production (i.e Nickel) than other subcategories under this main source category.

**Table 23: Dioxins and Furans (g TEQ/a) Releases from Ferrous and Non-ferrous Production**

Production type	No. of Industries	Production rate (t/a)	Annual Releases	
			Air	Residue
Foundries	1	6000	0.000	0.003
Copper	1	24 255	1.213	15.281

Production type	No. of Industries	Production rate (t/a)	Annual Releases	
			Air	Residue
Thermal non thermal metal (Ni)	1	24 255	2.426	0.000



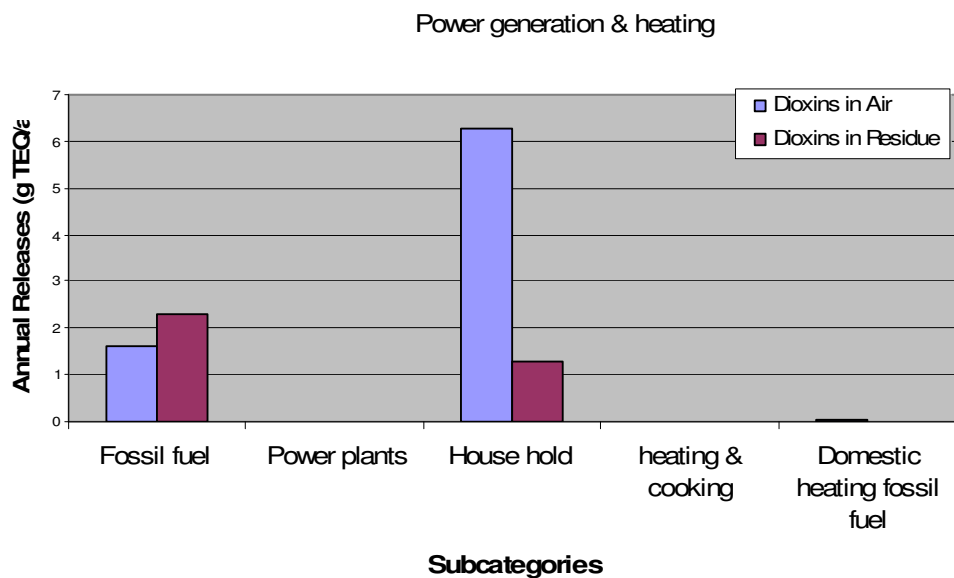
**Figure 36: PCDD/PCDF (g TEQ/a) Releases from Ferrous & Non-ferrous Production**

### Power Generation and Heating

This category focuses on power generation from fossil fuel, biomass and biogas as well as cooking and heating by consumption of fuel and biomass. Table 24 and Figure 37 below gives a summary and comparison of the types of power and heating generations performed in Botswana and their respective releases of dioxins and furans. The dioxins and furans releases are mainly in the air and residue. Household heating and cooking releases more dioxins in the air than the other subcategories.

**Table 24: PCDD/PCDF emissions from Power Generation**

Power type	Production Rate (Tj)	Emission Factors (Air) (µg TEQ/t)	Annual Releases (Air) (g TEQ/a)	Emission Factors (Residue) (µg TEQ/t)	Annual Releases (Residue) (g TEQ/a)
Fossil fuel Power plants	161 783	10	1.618	14	2.3
House hold heating & cooking	62 588	100	6.259	20	1.3
Domestic heating fossil fuel	31 294	1.5	0.047	0	0



**Figure 37: PCDD/PCDF Annual Releases from Power Generation & Heating**

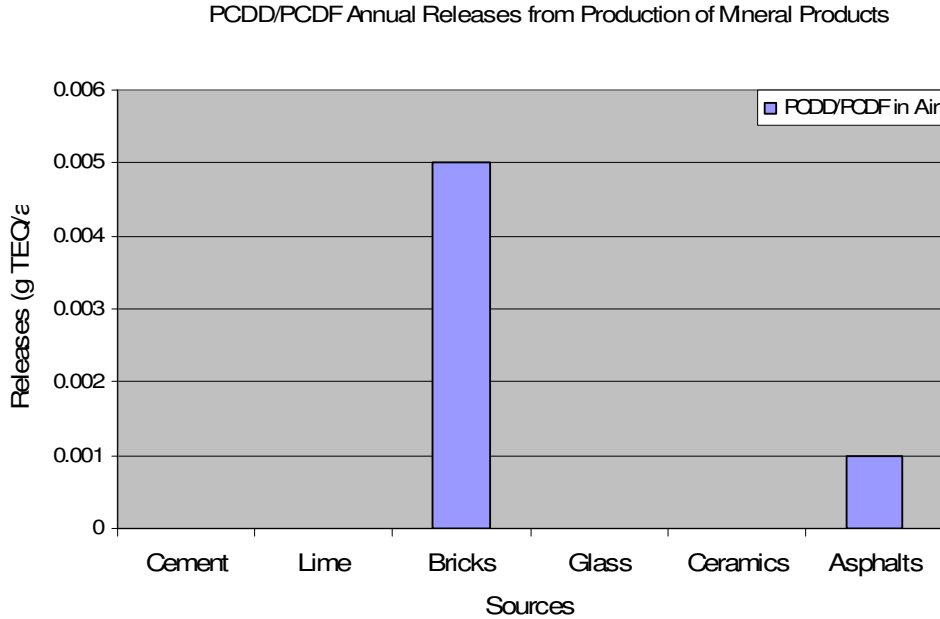
### Production of Mineral products

This category depends on high temperature process for melting or thermally induced chemical transformation. As a result of these processes, dioxin and furan releases are emitted in the air with minor emission releases in the residue. According to the survey, three facilities were found under the mineral production sector in Botswana, and these are Brick production and Asphalt mixing.

Asphalt production has the highest production with 10 9980 t/a resulting from one asphalt mixing company and two industries were found to produce bricks with an annual production of 25051 t/a. Table 25 and Figure 38 below presents a summary of dioxins and furans releases from production of these mineral products. Brick production showed the highest the highest release of dioxins and furans in the air of 0.005 g TEQ/a.

**Table 25: Dioxin and Furans releases from Mineral Productions**

Production Type	Number of Industries	Production Rate (t/a)	Annual Releases Air (g TEQ/a)	Annual Releases Residue (g TEQ/a)
Brick	2	25051	0.005	0.00
Asphalt mixing	1	109980	0.001	0.00



**Figure 38: PCDD & PCDF Annual Releases from Production of Mineral Products**

### Transportation

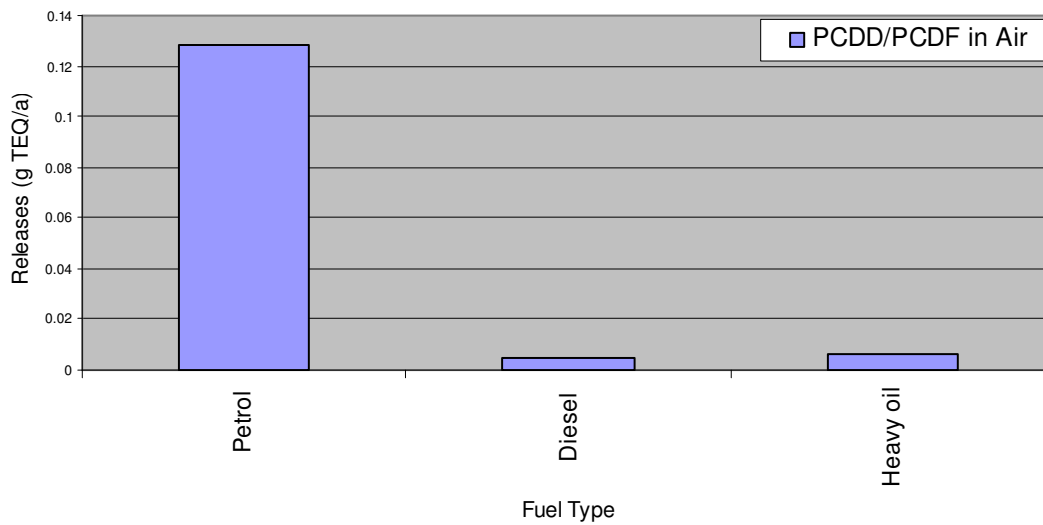
The release of dioxins and furans in the transport sector depends primarily on the type of fuel burned as well as the engine type. The use of leaded fuel leads to higher emissions of dioxins and furans in the air as compared to other fuel types. Table 26 and Figure 39 below gives a summary of the comparison these fuel types as used in Botswana.

**Table 26: PCDD & PCDF Emissions from Transportation**

Fuel Type	Fuel Consumption (t/a)	Annual Release (Air)- (g TEQ/a)
Petrol	76 388	0.128
Diesel	53 020	0.005
Heavy Oil	1 392	0.006

The overall estimated annual consumption for all the three types of fuels amounts to 130800 tonnes per year in 2006. This yearly consumption gave an annual release of dioxins and furans of 0.139 g TEQ/a in the air.

Category 5: Transportation



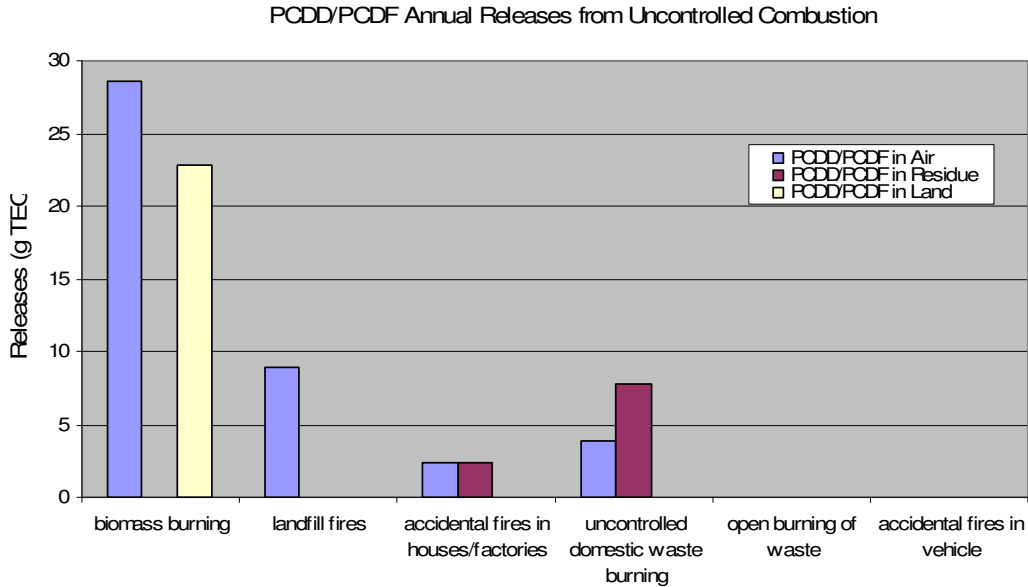
**Figure 39: PCDD & PCDF Emissions from Transportation**

**Uncontrolled Combustion Processes**

This category includes combustion processes that occur in open air rather than in a controlled manner, with some of the fires occurring accidentally and other due to human activities Table 27 and Figure 40 summarises dioxins and furans annual releases from this category. Forest fires releases more dioxins and furans in the air and in the land respectively than to other subcategories.

**Table 27: Dioxin and Furan releases to Air (g TEQ/a) by Uncontrolled Combustion.**

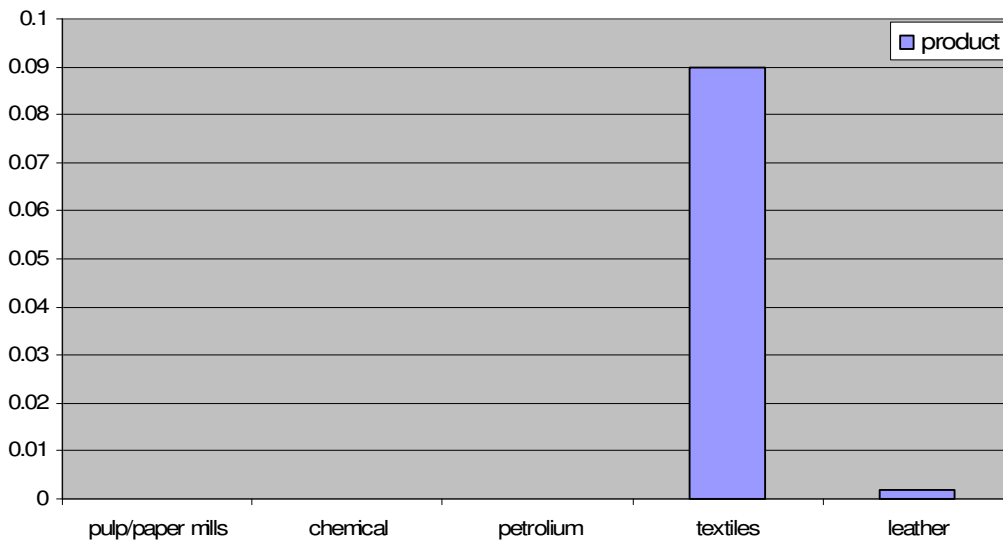
Sources	Dioxin and Furan Releases to Air ( g TEQ/a )
Biomass Burning	26.627
Dumping sites/Landfill Fires	9.00
Accidental Fires in Houses/Factories	2.4
Uncontrolled Domestic Waste Burning	3.9
Accidental Fires in Vehicles	0.004
Open burning of waste	0.042



**Figure 40: PCDD/PCDF Annual Emissions from Uncontrolled Combustion**

**Production of Chemicals and Consumer Goods**

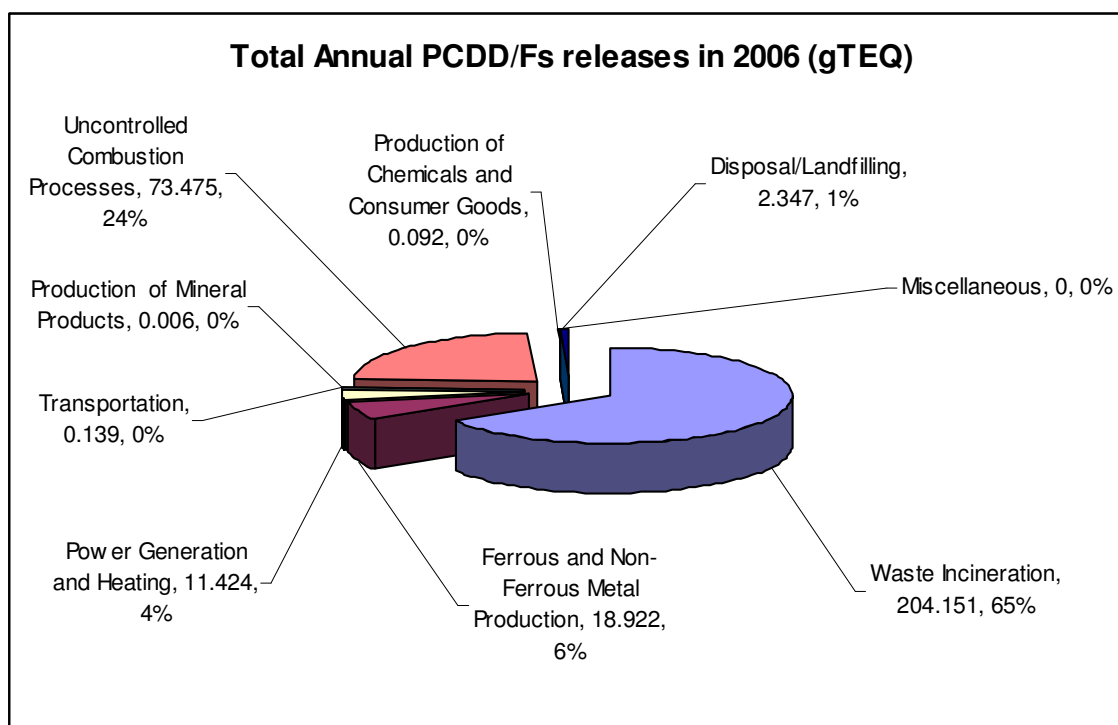
Dioxins and furans are released from several industrial processes that produce consumer goods as their products. Releases of dioxins and furans in the product are illustrated in Figure 41 below as a comparison of resulting emissions from textiles and leather plants. It is clear that textile play a significant role in the release of dioxins and furans in the products as compared to leather plants.



**Figure 41: PCDD/PCDF Releases from Production of Chemicals & Consumer Goods**

### Overall Dioxins and Furans Releases

Botswana's 2006 overall dioxins and furans emissions for different categories are released in the air, water, land, product and residue and gave a total of 291.883 g TEQ per annum, and the summary of these is presented in Table 28 and Figure 42 below.



**Figure 42: Overall Dioxin and Furan Releases per category for 2006**

**Table 28: Overall Dioxins and Furans Emissions per category**

Source Categories	Annual Releases (g TEQ/a)					
	Air	Water	Land	Products	Residue	Total
Waste Incineration	203.156	0.000	0.000	0.000	0.995	<b>204.151</b>
Ferrous and Non-Ferrous Metal Production	3.638	0.000	0.000	0.000	15.284	<b>18.922</b>
Power Generation and Heating	7.924	0.000	0.000	0.000	3.5	<b>11.424</b>
Production of Mineral Products	0.006	0.000	0.000	0.000	0.0	<b>0.006</b>
Transportation	0.139	0.000	0.000	0.000	0.0	<b>0.139</b>
Uncontrolled Combustion Processes	41.973	0.000	2.599	0.000	10.2	<b>54.772</b>
Production of Chemicals and Consumer Goods	0.000	0.000	0.000	0.092	0.0	<b>0.092</b>
Miscellaneous	0.000	0.000	0.000	0.000	0.0	<b>0.0</b>
Disposal/Landfilling	0.000	0.047	0.000	0.000	2.336	<b>2.347</b>
Identification of Potential Hot-Spots	0.000	0.000	0.000	***	0.0	<b>0</b>
<b>Total</b>	<b>256.83</b>	<b>0.047</b>	<b>2.599</b>	<b>0.092</b>	<b>32.315</b>	<b>291.883</b>

#### **2.3.4.5 Discussion**

The results show that a significant amount of releases into the air are from waste incineration followed by uncontrolled combustion processes. This is due to the fact that most incinerators in Botswana do not have air pollution control systems, and most of them are not properly operated according to the manufactures specifications. The survey has also revealed that the amount of hospital waste to be incinerated out numbers the number of incinerators in Botswana. This means there is a lot of clinical waste produced in Botswana and in some instances reasonable number of incinerators are not operational for certain period of time.

From the results, waste incineration and uncontrolled combustion processes are potentially the most significant sources of dioxins and furans in Botswana. These two source categories contribute approximately 90% of the total dioxin and furan estimates. The following source categories are the second major sources of dioxins and furans and they are arranged in order of decreasing contribution of these pollutants:

1. Ferrous and non-ferrous metal production
2. Power generation and heating
3. Production of mineral products

These three sources categories contribute about 8% of the total estimates of the dioxins and furans, with ferrous and non-ferrous metal production giving approximately 60% of the emissions of this group. Miscellaneous and Hot Spot source categories did not have a significant role in the emissions of dioxins and furans in country, therefore they were not considered in the overall emissions in the study.

#### **2.3.4.6 Limitations of the Study**

- Information was requested from selected stakeholders, and this was time consuming as it required contact follow-ups with many of the facilities or sectors to ensure a satisfactory response. The facilities or contact list were asked to respond with any specific comments on the inventory for their given industry sector. The information requested was on voluntary basis, some of the stakeholders did not provide data.
- Data gaps in this inventory were contributed partly by inadequate cooperation of industries and non-industries facilities. Some sectors or industries delayed on providing the data, while some of the gaps are due to the fact that some of the sectors or sub-categories are not applicable to the country.
- Emission results are based on default emission factors, and these results are likely to be reflective of relative good operational practice. Therefore the results may not be indicative of the likely emissions during process upsets or abnormal operations.
- Some source categories may have such variable operational conditions that may be difficult to reliably predict emissions from these sources using limited data.
- Application of the default emission factors to Botswana source data is prone to some uncertainties due to potential differences in technologies and practices as well as pollution control systems.

#### **2.3.4.7 Conclusion and Recommendation**

##### **Conclusions**

- Dioxins and furans are released to air more than to other media

- Waste incineration releases more dioxins and furans to air than all other sources
- The use of low air pollution control system incinerators will continue to be a significant source of these persistent pollutants until they are phased out.

### **Recommendations**

- From this inventory, the results have revealed that waste incineration is the principal source of dioxins and furans released to air. For total elimination or reduction of these pollutants in Botswana, it is suggested to put in place incinerators with good if not high air pollution control system.
- Most incinerators in Botswana were constructed some years back, and they were built with a single chamber. It could also be recommended that incinerators to be constructed in some years to come have both primary and secondary chambers.
- To improve the country's update of the inventory, it is recommended that a work plan be put in place for future country's update of the inventory.
- For further improvements in the future inventory update, it is suggested that sampling and analysis data be used for local dioxin and furan emission factors instead of relying on the default emission factors.

### **2.3.5 Information on the state of knowledge on stockpiles, contaminated sites and wastes, identification, likely numbers, relevant regulations, guidance, remediation measures and data on releases from sites**

#### **2.3.5.1 Introduction**

Following the inventories exercise in which not many POPs pesticides were found but indeed some quantifiable PCB polluted oils in transformers that are no longer in use, then the places where such are stored are considered polluted sites as they were many were found in bad conditions such as weariness and leaking; thus this report serves to give account of their existence and status.

The objective of this section is to document stockpiles, contaminated sites and wastes of POPs chemicals. The long term objective is to put in place measures to deal with the consequences of the effects of POPs but to fully implement the provisions of the Convention, there is urgent need to develop National Implementation Plans (NIP) to guide in the implementation process. To be able to develop sound National Implementation Plans, there is need to know what the situation is on the ground in connection to POPs inventories, stockpiles, contaminated sites and wastes.

This survey exercise was therefore carried out to determine the level and status of stockpiles, contamination and wastes of POPs as well as to determine the current efforts to address the problem of POPs. Issues addressed through the survey were:

- Knowledge on chemicals in general wastes
- Knowledge on POPs stockpiles
- Knowledge on chemical polluted sites

#### **2.3.5.2 Institutional and regulatory framework**

According to Waste management Act, there is citation of the “polluter pays” principle, that it is the responsibility of the polluter to clean and rehabilitate the polluted site if it was proven that the pollution was actually caused by them.

### 2.3.5.3 Methodology

Various teams undertook surveys and data was then availed to the Pesticides and Contaminated Task Team to produce the report.

### 2.3.5.4 Contaminated sites with POPs

There was no POPs pesticides contaminated site identified in this survey, this may be so because of the evidenced low utilization of POPs pesticides for agricultural purposes. However it cannot be concluded that there is no contaminated site in the country since the survey was only biased towards the Agricultural Regions whose selection was as outlined in the Inventories report.

On the other hand, the situation with potentially contaminated locations with PCDD/PCDFs was different. Table 29 summarizes the situation with all the surveyed areas. Note that in some categories data was not available hence that notation “no”. However more work need to be done especially with the areas where companies can provide data, though it is difficult to get information with individually owned properties as vehicles and domestic power or heat productions etc.

**Table 29: PCDD/PCDFs related potentially contaminated sites**

MAIN SOURCE CATEGORY	SUB CATEGORY	SOURCE INFORMATION	OF	Availability
<b>1. Waste incineration</b>	Municipal solid waste incineration	Not applicable.		Not applicable
	Medical/hospital waste incineration	Hospitals and clinics		Yes
	Animal carcasses burning	BMC ,Crematorium		Yes
<b>2. Ferrous and non ferrous metal production</b>	Foundries	Foundries		No
	Copper production	Selibe-Phikwe(BCL)		No
	Aluminium production (all sec.)	Mochudi		No
	Lead production	Gaborone(Chloride Exide)		No
<b>3. Power Generation and Heating/Cooking</b>	Fossil fuel power plants	Morupule (BPC) Botash		Yes Yes
	Household heating and cooking - Biomass	CSO Energy Affairs		No No
	Domestic heating - Fossil fuels	CSO Energy Affairs		No No
<b>4. Production of Mineral Products</b>	Cement kilns	PPC Gaborone		No
	Brick	Makoro Bricks Lobatse Clay Works		Yes No

MAIN SOURCE CATEGORY	SUB CATEGORY	SOURCE INFORMATION	OF	Availability
	Asphalt mixing	Asphalt Botswana		No
5. Transport	Petrol Engines	Energy Affairs DTRS		No No
	Diesel engines	Energy Affairs DTRS		No No
	Heavy oil fired engines	Energy Affairs DTRS		No No
6. Uncontrolled Combustion Processes	Fires/burnings - biomass	Forestry Dept. Wildlife Dept.		No/Yes No
	Fires, waste burning, landfill fires, industrial fires, accidental fires	Local Authorities Fire Brigades		No/Yes No
7. Production of Chemicals, Consumer Goods	Textile plants	BURS Trade BDC		No No No
	Leather plants	Lobatse tannery		No
8. Miscellaneous	Tobacco smoking	Trade CSO		No No
	Crematoria	Funeral Parlors		Yes
9. Disposal/Landfill	Landfill leachate	Local Authorities Meteorology		No No
	Sewage/sewage treatment	Local Authorities		No
	Open water dumping	Town and Regional Planning CSO Industries		No No No
10. Identification of Hot Spots	PCB containing equipment	BPC Tati-Nickel		Yes Yes
	Dumps of waste/residues from categories 1-9	Categories 1-9		No

The following table (Table 30) also summarizes information on pesticides stockpiles at the Plant Protection Warehouse

**Table 30: Total quantities of obsolete pesticides with Plant Protection Division**

Period	Quantities collected	Comments
Prior to the year 2003/04	44 417 kg or litters	Of that 2403 containers listed (34% of which were empty)
The year 2004/05	1 603 kg	the bulk of this material was empty containers
the year 2005/06	2 370 kg	the bulk was empty plastic containers
the year 2006/07	3 348 kg	the bulk was empty plastic containers

<b>Total</b>	<b>51 738 kg</b>	
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Another stock pile of about 3000 Odor Bated Targets (OBT) which currently has no use since the Department of Animal Health and Production (DAH & P) declared a complete elimination of the problematic tsetse. The stock pile was found inside a shed at the Department's Office Storage in Maun. The targets were made in anticipation of the tsetse pandemic which latter succumbed and have been in store ever since 2002.

### 2.3.5.5 Preliminary identification of priority sites

According to the information provided above it would appear that urgent attention needs to be placed in the following order:

1. Stockpile of obsolete pesticides and empty containers at the Sebele warehouse. This need to be remedied urgently as it is the only such facility that serves the whole nation and it is filling up to space fast which underpins the importance for clearance of the current stock so that other recent wastes could be cleared off the fields since agriculture is a yearly thing so does the accumulation of waste.
2. PCB polluted and decommissioned transformers. For too long they have not been attended to and they are currently leaking to the ground. There is need to have in place measures beyond the stockpiling i.e. final destruction as in incineration since the transformers have been decommissioned.
3. Data availability of disposal and land filling sites. Due to the evidence of open burning 24 hours in days in the various disposal and open land filling it is necessary to know exactly the quantities of dioxins and furans that are produced so that the burning could be controlled. In the current situation the problem could be much bigger that currently thought of if internationally recognized limits are over passed.

### 2.3.6 Summary of future production, use and releases of POPs requirements for exemptions

#### 2.3.6.1 Summary forecast of POPs production, use, import, export and unintentional releases

The summary of future production, use, import, and export of POPs is elaborated in Table 31.

**Table 31: Summary of future POPs production, use, import, export and releases**

Year	2006 Baseline Inventory	2007	2010	2020	2030	Remarks
<b>POPs PESTICIDES</b>						
<b>Production</b>	Kilograms	Kilograms	Kilograms	Kilograms	Kilograms	
Aldrin	0.00	0.00	0.00	0.00	0.00	
Chlordane	0.00	0.00	0.00	0.00	0.00	
Dieldrin	0.00	0.00	0.00	0.00	0.00	
Endrin	0.00	0.00	0.00	0.00	0.00	
Heptachlor	0.00	0.00	0.00	0.00	0.00	
Hexachlorobenzene	0.00	0.00	0.00	0.00	0.00	
Mirex	0.00	0.00	0.00	0.00	0.00	
Toxaphene	0.00	0.00	0.00	0.00	0.00	
<b>Use/Import</b>	Kilograms	Kilograms	Kilograms	Kilograms	Kilograms	

Year	2006 Baseline Inventory	2007	2010	2020	2030	Remarks
					ms	
Aldrin	0.00	0.00	0.00	0.00	0.00	
Chlordane	168	178	0.00	0.00	0.00	Assume 6.2% real GDP growth
Dieldrin	0.00	0.00	0.00	0.00	0.00	
Endrin	0.00	0.00	0.00	0.00	0.00	
Heptachlor	0.00	0.00	0.00	0.00	0.00	
Hexachlorobenzene	0.00	0.00	0.00	0.00	0.00	
Mirex	0.00	0.00	0.00	0.00	0.00	
Toxaphene	0.00	0.00	0.00	0.00	0.00	
<b>DDT</b>	Kilograms	Kilograms	Kilograms	Kilograms	Kilograms	
Production	0.00	0.00	0.00	0.00	0.00	
Use/Import	30*	0.00	TBD	TBD	TBD	*The use could not be traced
<b>PCB</b>	Cubic metres	Cubic metres	Cubic metres	Cubic metres	Cubic metres	
<b>Production</b>	0.00	0.00	0.00	0.00	0.00	
<b>Use</b>	16,570	NI	TBD	TBD	TBD	
<b>Waste</b>	500*	NI	TBD	TBD	TBD	*Pieces of equipment
<b>Releases from Unintentional Production</b>	(g TEQ/a)	(g TEQ/a)	(g TEQ/a)	(g TEQ/a)	(g TEQ/a)	
<b>Dioxins and furans (PCDDs/PCDFs)</b>	<b>2006</b>	<b>2007</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	
Waste incineration	204.151	NI	TBD	TBD	TBD	Assume real GDP growth of 6.2 %
Ferrous and non-ferrous	18.922	NI	TBD	TBD	TBD	Assume 7.4% sector growth rate
Power generation and Heating	11.424	NI	TBD	TBD	TBD	Assume 7.4% sector growth rate
Production of Mineral Products	0.006	NI	TBD	TBD	TBD	Assume 7.4% sector growth rate
Transportation	0.139	NI	TBD	TBD	TBD	Assume real GDP growth of 6.2 %
Uncontrolled Combustion Process	54.972	NI	TBD	TBD	TBD	Assume real GDP growth of 6.2 %
Production of Chemicals and Consumer Goods	0.092	NI	TBD	TBD	TBD	Assume real GDP growth of 6.2 %
Miscellaneous	0.00	NI	TBD	TBD	TBD	Assume real GDP growth of 6.2 %
Disposal/Landfilling	2.347	NI	TBD	TBD	TBD	Assume 6.8% sector growth rate
<b>Hexachlorobenzene (HCB)</b>	ND	ND	ND	ND	ND	
<b>Polychlorinated</b>	ND	ND	ND	ND	ND	

Year	2006 Baseline Inventory	2007	2010	2020	2030	Remarks
biphenyls (PCBs)						

\*TBD: To Be Determined  
 \*\*TEQ = Toxic Equivalent  
 \*\*\* baseline data for 2005 = 158 kg  
 NI: No Information

### 2.3.6.2 Import, use of chlordane

Table 31 above indicates that some chlordane was imported into the country, i.e 169 kg 2003 and 152kg in 2004/2005. The POPs Pesticides inventories have confirmed that chlordane is used as ant poison, especially in the building industry. It could not be determined whether there will be continued used of this chemical, since its import and use is not adequately regulated. Monitoring of the import may also be problematic as the data at certain instances report the import of the chlordane in combination with chlorocamphene.

### 2.3.6.3 Import, Use of DDT

The inventories indicate that the use of DDT was discontinued in 1997, however the data provide by the Central Statistics Office (as shown in the table above), indicate that some 30kgs were imported into the country in 2004 (20kg) and 2005 (10kg). It could not be determined. The Ministry will in due course file a notification with the WHO and the Stockholm Convention Secretariat of their intention to revert to the use of DDT, starting 2008. The quantities to be used will be determined at a later stage.

### 2.3.6.4 Annex C POPs

During the inventory process PCBs and HCB releases were not inventoried due to unavailability of tool kits and or assumption techniques. However inventories on Dioxins and Furans were undertaken and the intention is to have continuous release reduction of these chemicals by approximately 2% per annum.

### 2.3.6.5 Requirements for exemptions

Based on the inventory exercise, the government of Botswana will not file for exemptions. This is because DDT will be used only for malaria vector control and chlordane will need to be phased out latest by 2010.

## 2.3.7 Existing programmes for monitoring releases and environmental and human health impacts, including findings

### 2.3.7.1 Introduction

In their endeavour to better their quality of life, human beings have inherently generated different streams of waste that has impacted negatively on the receiving environment. As a result, the country has recognised the need to address the negative impacts as they relate to interference with land use practises, public health and safety, aesthetic, tourist attraction, and national image.

The pollution problem in Botswana started in the early 1970 mainly from mining industries. This was later followed coal fired boilers and other polluting sources. Botswana is rated as one of the fastest growing countries in the world and this development has brought with it the rapid increase in the number of vehicles in the country. This implies that the contribution of motor vehicle exhaust emissions to the atmospheric pollution is also increasing.

### **2.3.7.2 Policy and legislative framework**

#### **The Atmospheric Pollution Prevention Act (APPA)**

The Botswana Air Pollution Monitoring and Surveillance Programme is a Government of Botswana programme aimed at combating the effects of air pollution in the country. The major objective of the monitoring programme is to check compliance of industries with the provisions of the APPA of 1971.

Under the act, industrial processes capable of releasing airborne contaminants into the atmosphere are required to have a valid Air Pollution Registration Certificate (APRC) or permit in order to operate. The application for APRC is made in a prescribed form that provides for detailed description of the following:

- The process including quantities and quality of raw materials;
- Type of process or processes to be used as well as process conditions such as temperatures and pressure;
- Expected Products;
- Quantities of air pollutants to be released into the atmosphere;
- Stack parameter such as height, diameter etc.; and
- Air pollution abatement measures to be undertaken.

The information presented in the application as described above is used to calculate and set maximum emission rates of pollutants into the atmosphere. These are then prescribed in the APRC as emission standard or the maximum limit for which the industrial process concerned should comply with at all times. The setting up of the emission standards takes into account the nature of the process, toxicity of the pollutant generated and the sensitivity of the receiving environment. Other terms and conditions, relating to equipment operation and process conditions, are also stated in the APRC. Each process is treated individually and given its own emission standard limiting the amount of air contaminants that can be discharged into the atmosphere. The big potential polluters are also required to set up a self-monitoring programme that will assist them on day-to-day basis to determine their compliance with the law.

#### **Air Quality Objectives**

The emission standards are designed such that the concentration of criteria pollutants in the atmosphere would be within the Botswana Air Quality Objectives (BAQO) shown in Table 32 when the plume reaches the ground. BAQO describe clean air and are established to protect all members of the public especially the most sensitive individuals against the impacts of air pollution. They define the maximum amount of pollutant that can be present in outdoor air without compromising the health of the public. Compliance with the emission standard and other terms and conditions of the APRC is monitored through inspections, environmental audits and source testing.

**Table 32: Botswana air quality objectives for pollutants**

<b>Pollutant</b>	<b>Standard Value</b>
<b>Particulate Matter (TS)</b> Annual average Monthly average	100 µg/m <sup>3</sup> 200 µg/m <sup>3</sup>
<b>Sulphur Dioxide (SO<sub>2</sub>)</b> Annual average Monthly average 24 hour average	80 µg/m <sup>3</sup> 160 µg/m <sup>3</sup> 90% of hourly observations to be less than 300 µg/m <sup>3</sup>
<b>Carbon Monoxide (CO)</b> 8 hour average 1 hour average	10 000 µg/m <sup>3</sup> 40 000 µg/m <sup>3</sup>
<b>Nitrogen Dioxide (NO<sub>2</sub>)</b> Annual average Monthly average 1 hour average	100 µg/m <sup>3</sup> 200 µg/m <sup>3</sup> 400 µg/m <sup>3</sup>
<b>Ozone (O<sub>3</sub>)</b> 8 hour average 1 hour average	157 µg/m <sup>3</sup> 235 µg/m <sup>3</sup>

### 2.3.7.3 Air pollution monitoring activities in Botswana

A coordinated air quality management system exists in Botswana comprising of twenty three air pollution monitoring stations operating on a continuous basis. The distribution and number of stations (Table 33) in any particular locality are based on the anticipated level of pollution due to the intensity of human activities in that area.

**Table 33: Air pollution monitoring stations in the country**

<b>Town</b>	<b>Location</b>
Gaborone	Civic Centre
	Fire Brigade
	Old Naledi
	Marang CJSS
Lobatse	Lobatse Bus Rank
Kanye	Segopotso Primary School
Moshupa	Diratsame CJSS
Molepolole	Canon Gordon Memorial School
Tlokweng	Botsalano Primary School
Mahalapye	Rural Administration Centre
Palapye	Mabogo CJSS
Morupule	Morupule Colliery

<b>Town</b>	<b>Location</b>
Serowe	Serowe College of Education
Selebi Phikwe	WUC
	BDF
	Kopano
	Railway Track
Mmadinare	Makome CJSS
Tonota	Tonota College of Education
Francis-Town	Blue Jacket Street
	City Council
Maun	HOORC

The monitoring program is augmented with a mobile air pollution monitoring laboratory. The mobile unit was acquired because it was realized that to set up monitoring stations at all desired locations in the country would prove too costly. The mobile laboratory is equipped to measure a wide spectrum of ambient and occupational air pollutants (O<sub>3</sub>, HCs, SO<sub>2</sub>, H<sub>2</sub>S, NO<sub>x</sub>, NH<sub>3</sub>, CO) while continuously recording meteorological data. It can easily be driven to any area of concern or from site-to-site, thus serving as an instant on-site monitoring station. At the end of the sampling period, conclusion can be made with respect to the air quality and the likely health impacts on the community in the area. The mobile laboratory is especially useful during times of accidents involving hazardous materials or in emergency situations.

The DWMPC also established a National Environmental Laboratory to facilitate proper and accurate monitoring of pollutants in the atmosphere, as well as the control of industrial pollution. The laboratory started operating in 2002. It has the latest analytical instrumentation, sensor, and monitor technologies with data transfer, database development, quality assurance, statistical and numerical models as well as advanced computer platforms for processing, distributing and presenting data and model results. The laboratory is extensively used for the analysis of water, air and soil samples in strategic areas across the country to determine and assess environmental pollution that informs our regulatory and control mechanism.

Persistent organic pollutants are not monitored (i.e. dioxins and furans). Food and Feeds are not assessed for contamination such as DDT, PCBs, and other POPs.

### **2.3.8 Current level of information, awareness and education among target groups**

#### **2.3.8.1 Summary**

To determine the level of public awareness on persistent organic pollutants (POPs), a survey was undertaken amongst various groups of stakeholders. The major findings from this survey are that 74.58% of the farmers surveyed said they did not know anything about POPs, the general public category showed that 62.50% did not know about POPs while government employees group showed the highest knowledge on POPs at 62.26%. The overall level of awareness from this

survey is 43.26% while 56.74% of the respondents did not know about POPs. The very high percentage amongst government employees group can be attributed to the fact that many of the respondents were environmental health officers who deal with chemicals on daily basis and by virtue of their training have been exposed to issues of POPs. Majority of the people who knew about POPs had some science based training or some by virtue of their work were exposed to chemicals information.

The survey also showed that 49.15% of the farmers had access to information on safe handling of chemicals. This high percentage can be attributed to the ongoing Programme by the Ministry of Agriculture to build awareness on safe handling of pesticides amongst the farming community. Although the level of awareness on POPs in general may be above the expected level, discussions with respondents showed that majority do not know anything beyond the word persistent organic pollutants. This therefore implies that public awareness raising on POPs has been non existent or very low. Generally this calls for rigorous awareness building programme on POPs for all the groups of stakeholders and may be particular emphasis on chemicals user categories. Furthermore the study has showed a need to build awareness amongst those that sell chemicals to the general public since many of those who did not have chemicals training background knew very little about POPs and general chemicals use. This limited knowledge creates a situation where the customers do not get the needed advice from the agent but tend to rely mostly on the use of directions for use that come with the product. In cases where the public is illiterate, this scenario poses a great danger of the chemicals not being used in a safe manner both to the environment and human health.

The major findings from the inventory exercise are that majority of the people are not aware of POPs and POPs related issues. Sometimes in cases where people have an idea about POPs, it is only a small number that have in depth knowledge or understanding of the subject. Further to this information on chemicals in general is not readily available to enable the public to make informed decisions on the use and handling of the various chemicals that are available in the market. The Ministry of Agriculture has started raising farmers' awareness on management of pesticides. This has to some extent raised the level of farmer's understanding on issues of management including chemical waste disposal principle. It has been observed that although the results from the Ministry of Agriculture's Programme point to a positive impact on the part of the farmers' understanding of pesticides management, the issue of POPs does not seem to feature prominently based on the farmer's responses.

The inventory also showed that environmental information in general is not readily available to the general public thus creating a deficiency in the environmental knowledge base amongst key stakeholders in the area of environment. Inadequate environmental awareness amongst the general public can not in any way help advance the cause of attaining sustainable development in the country.

The review of Policies and Legislation has clearly shown that issues of POPs are not explicitly addressed anywhere. Some Acts like EIA are assumed to address POPs simply because it addresses issues of project inputs and outputs and their impact on the environment and calls for alternative measures where necessary. The Agrochemicals Act is also silent on issues of POPs. Some POPs are useful substances that are still used to address some of the human needs such as in the case of mosquito control as a public health issue, the use of such chemicals in the building industry and the use of PCBs such as in transformers. Issues of unintentional release of POPs are some of those issues that nowhere in the Policies and Legislation are addressed. Therefore these are some of the issues that Policies and Legislation need to take on board if the country is to effectively implement the POPs Convention.

There are limited Policy issues relating to public information dissemination and environmental awareness in general. Where Policies or drafts exist, they do not extensively address issues of awareness and information dissemination and by extension nothing on POPs information in particular. Through the inventory exercise it has come out clearly that capacities at all levels on management of chemicals and POPs in particular are inadequate. It is therefore crucial that issues of capacity at both institutional and community levels are addressed.

There is need to address the issue of resource mobilization if the actions outlined in the national implementation plan are to be effectively implemented. For public awareness to be successfully carried out, information capturing and dissemination tools need to be in place. Not only should they be in place but they should also be accessible and affordable to the general public.

We are living in a technologically advanced and evolving world where the information super high way is the order of doing business. Although these technologies have made communication easier, it remains in a dream world for many in the developing countries especially the rural communities where the requisite amenities are not readily available. The need for government to provide an enabling environment for the private sector to come in to set up some of the necessary infrastructure in the rural areas to ease communication is critical.

### **2.3.8.2 Introduction**

The awareness Team was made up of 5 institutions. These included government, NGOs educational institutions as partners in the implementation of the Convention. The task team had meetings from time to time to chart the way forward on the awareness inventories assignment including, data collection and analysis modalities, report preparation and eventually production of the national implementation plan. The data collection exercise for POPs awareness level determination was done through the use of a questionnaire. The coverage included the following target groups, farmers, industries dealing in chemicals, government establishments, the general public as well as students. However due to the small sample size of the public and student category, the two were not included in the analysis except for overall level of POPs awareness determination.

The task team started by mapping a strategy for tackling the assignment this included development of a work plan detailing the objectives and time lines for execution of planned activities. The exercise also included determining the stakeholder groups to be covered in the survey process.

The survey exercise started in October 2006. The first survey done covered mostly farmers. The survey was done in through three teams each covering one administrative Local District. To finalize the data collection exercise, one team went to Francistown area in April 2007. The team interviewed various target groups including, industries, general public and students.

Additional data was collected through the PCB task team which went around the country for PCB inventories. Under awareness the group covered mostly government institutions. Apart from the field survey there was also an inventory of Policies and Legislative Instruments done to determine how much they addressed the issues of POPs and in particular POPs awareness.

### **2.3.8.3 Overview of Public Policy on Awareness and Information Dissemination**

In 1997 Botswana developed its Long Term Vision “Towards Prosperity For All” commonly known as Vision 2016. The Vision has become a guiding principle for the country’s development processes. Vision 2016 was conceived and crafted to address both national and global challenges that the country is grappling with. Some of the dreams and aspiration the country has as outlined in the Vision 2016 document are; to be an educated and informed nation; this puts more emphasis on the quality of education offered and its accessibility. Furthermore the vision calls for improved access to information as well as its dissemination with emphasis on fully developed communication capacities particularly the electronic media and broadcast media. The Vision also aspires for Botswana to be a nation that is Prosperous, Productive and Innovative; this very pillar calls for sustainable growth and diversification through taking into consideration environmental considerations in our development processes. It further calls for the country to take strong measures of limiting pollution emanating from developmental activities. For the Vision to be realized all stakeholders must incorporate the principles of the Vision into their plans. Furthermore the Vision should guide development of national Policies, Plans, Programmes and Strategies.

The National Development Plan (NDP) is a six year development planning and implementation document that drives the country’s development processes as it details development Programmes, projects and strategies the government intends to undertake within a specified period in order to drive its national development agenda. For the first time in the NDP process, the current National Development Plan 9 has an environment chapter. This plus the establishment of the Ministry of Environment, Wildlife and Tourism in 2002 underpins the importance government attaches to issues of the environment and the need for other sectoral plans to take onboard environmental considerations in development planning processes in order to promote sustainable development. To further enhance environmental considerations, the national plan stresses the need to promote environmental awareness and also calls for ways and strategies of promoting public education and awareness on the environment. The NDP process as a vehicle for driving national developments in Botswana is very ideal for promoting awareness on POPs especially that it also provides for funding of all activities that are to be executed during any particular plan period.

Over and above the Vision 2016 and National Development Plan documents, Botswana has a number of Policies and Legislation relating to the various sectors of the environment and natural resources. This array of legislation and policies addresses issues of management of the various natural resources, waste and chemicals management as well as other developmental issues. They are aimed at promoting sustainable management and use of natural resources as well as sustainable development in general. Despite the existence of this body of policies and legislation, there is none that specifically addresses substantive issues on POPs management including information dissemination but rather general issues of the environment. Amongst the few Government Policies that put emphasis on promotion of environmental awareness and education is the National Policy on Natural Resources Conservation and Development commonly known as the National Conservation Strategy (NCS). Amongst the many objectives of the NCS the following two have close relevance to awareness and access to information; “the increased education of, and participation by, all members of society in improving the environment as well as the prevention and control of all forms of pollution. The Policy also emphasizes the expansion of facilities directed at improving environmental education, training and research activities, as well as raising public awareness on environmental issues. By improving and promoting environmental education and education infrastructure, Botswana would be in a position to deal effectively with environmental issues and in the end attain its vision objectives of an informed and educated nation as well as attainment of sustainable development.

Emanating from this emphasis on awareness and education by the NCS, a National Environmental Education Strategy and Action Plan (NEESAP) was developed in 1997 to drive the efforts of awareness building and education amongst the general public. The NEESAP has

recently been reviewed to take onboard latest developments in the area of environment in general as well as environmental education and awareness. The NEESAP implementation involves a wide range of stakeholders both within and outside government. The strategy and action plan promotes formal, non formal and informal education on issues relating to the environment in general.

Various institutions undertake public awareness raising activities on a wide range of environmental issues including chemicals management as in the case of the Ministry of Agriculture which deals mainly with pesticides handling at farm level.

In 1994 the government of Botswana adopted the Revised National Policy on Education (RNPE) within which there was a recommendation for the introduction of environmental education in schools curricula to promote awareness and education on issues of the environment in schools. As a result of this Policy, environmental education is now taught as a subject at primary schools and infused at secondary school levels. This gives an opportunity for issues like persistent organic pollutants and other pertinent environmental issues to be taught to students at an early age to help in building an environment conscious and friendly nation.

The Revised Policy emphasizes the need for establishment of school libraries and other resource centres to promote access to information on the environment. It also calls for teachers to be trained in subject infusion methodologies at pre-service and in-service levels for environmental education to ensure that learning results in attitudinal changes and citizen participation. Further to that the policy calls for educational institutions, starting with the teacher training institutions and the Universities to develop a culture of environmental consciousness and therefore be exemplary to the nation.

The Ministry of Communications, Science and Technology is developing a Policy that aims to address promotion of information, communication and technology development and dissemination in Botswana. The aim of the Policy is to create wealth and achieve better socio-economic well being for Botswana through effective utilization of information, communication and technology, the Policy aims to further support the aspirations of Botswana's national vision 2016. Some of the principles of the Policy are:

- Providing easy access to valuable information on health, jobs and education
- Moving government information and services on-line
- Connecting all schools and libraries to the internet
- Providing internet access centres and training in rural villages
- Providing all citizens with high speed, affordable internet access

These are just a sample of the many principles outlined in the Policy aimed at promoting information access and utilization for public benefit. The Policy provides a perfect launching pad for awareness building on matters of the environment and POPs in particular.

A communication strategy for promoting awareness and communication under the Okavango Delta Management Plan (ODMP) is being developed. The strategy is meant to promote awareness on the Okavango Delta, its importance to the delta communities, to the nation, the international community and the need to keep it in a state that it will continuously contribute to the lives of the delta communities and at the same time generate national income through the utilization of its natural resources in a sustainable manner. The strategy supports the implementation of the Okavango Delta Management Plan which addresses issues of sustainable management of the delta resources through involvement of all stakeholders in the delta region, at national and international levels.

The issue of POPs is very important in the Okavango Delta area because of the malaria and tsetse fly prevalence and hence the need to use mosquito and tsetse controlling chemicals. Although the use of DDT to control both mosquitoes and tsetse fly has been stopped in Botswana there is still a high possibility of it being reintroduced especially in the control of mosquito if substitute chemicals fail to control the mosquitoes. The communication strategy therefore offers an important vehicle for imparting information on POPs to the public. Considering that the Delta plays a pivotal role in the livelihoods of the delta communities, any activity that threatens the continued reliance on the delta resources has to be avoided by all means. The existence of POPs in such an area would be very detrimental to the entire ecosystem hence the need to sensitize the communities on the dangers of POPs. The ODMF communication strategy therefore offers an important avenue for reaching out to the public on issues of POPs awareness.

Botswana developed a waste management strategy in 1998 to address issues of waste management in a manner that is safe to both humans and the environment. The strategy emphasizes minimization of waste in industry, commerce and at household level and also promotes environmentally sound waste collection, treatment and disposal. The strategy emphasizes the following principles; Principle of prevention; which emphasizes minimization of environmental pollution. Polluter Pays Principle; it clearly points out that cost of environmental pollution should be borne by the polluter while the Principle of Co-operation calls for co-operation amongst all stakeholders in order to effectively address environmental problems.

Further more the strategy highlights the need to promote public awareness, education and communication on all matters relating to waste management. The strategy's major objectives are; to protect human health and the environment as well as protection of natural resources. Amongst its efforts to achieve the set objectives, the strategy specifically outlines public awareness and education. The strategy only goes as far as outlining waste such as that from laboratories, pesticides and herbicides but does not come up with actions of how such waste is going to be managed. It only indicates that there is not enough data on quantities generated in the country. However it acknowledges that these can potentially present a major environmental hazard.

A baseline study on chemical safety awareness undertaken by Community Health Service-Environmental Health Unit of the Ministry of Health in 1999 showed that disposal of chemical waste in factories was a serious problem and threat to both the environment and human health. Most industries visited did not have an organized way of depositing off the waste such that it ended up in sedimentation ponds within the compounds, some burn or dump chemical waste. Spillages washed from floors end up in municipal drainage systems because there are no safety measures in place to deal with spillages. Some factories even go to the extent of selling containers to their employees. Due to the low level of awareness on the dangers associated with the use of the containers employees buy and some end up selling to the general public. Some times even the storage of the chemicals is such that it poses a serious threat to the employees. In case any of these chemicals happens to be POPs, the employees would be at high risk of exposure and hence a threat to their health.

There is no policy that specifically addresses POPs neither is there a strategy in place specifically developed to address issues of awareness on POPs. It is only addressed as another of the environmental issues that face the country and should be tackled effectively. The ratification of the Stockholm Convention should therefore give Botswana an opportunity to bring afore issues of POPs and make them a component of the country's plans.

In support of environmental policies in place are a number of legislation passed to promote sustainable management of the environment. An Environmental Impact Assessment Act was passed by Parliament in 2005 and is being implemented. The aim of the Act is to promote sustainable development by taking into account environmental considerations when planning

development projects. Through the Act, projects are subjected to environmental impact assessment so as to minimize the negative impacts of developments on the environment. The Act obviously lends itself to addressing issues relating to the use of POPs and would recommend alternatives where possible. Awareness raising on the Act and its implications has been done and is still ongoing and will for a long time be continued to ensure that the general public is fully aware of the Act. The Act stresses the need for affected and interested parties to any development being proposed to be part of the decision making process.

From waste management standpoint, the Waste Management Act promulgated in 1998 covers planning, facilitation, and implementation of waste management systems and control of waste. The major aim is to protect both human and other forms of life from being negatively affected by waste that is not properly handled. Through minimization of environmental pollution the Act promotes environmental conservation. Through this Act, the country now concentrates on building landfills instead of dumping sites where currently the issue of waste burning is common hence a contribution to production of unintentional production of POPs. It is common practice at household level to burn waste as a management practice, the Waste Management Act discourages this practice. The Waste Management Act also takes on board handling and disposal of hazardous waste by embracing the Basel Convention on Trans-boundary movement of hazardous waste. By incorporating the Basel Convention, this Act promotes environmentally sound management of all forms of waste in the country. Through the Act, hazardous and other non-hazardous waste will be managed in a proper manner to ensure the protection of human health and the environment against any adverse effects which may result from such waste.

The Atmospheric Pollution (Prevention) Act was enacted in 1971 with the main objective being to “provide for the prevention of the pollution of the atmosphere by the carrying on of industrial processes and for matters incidental thereto.” The Air Pollution Control Act calls for production of annual reports detailing the implementation of the Act in that particular year. The report is to be presented to Parliament by the responsible Minister. The Act gives the Minister powers to publish and disseminate information and to call for development and implementation of educational programmes as a way of promoting awareness and education on atmospheric pollution. The air pollution division of the Department of Waste Management and Pollution Control does air quality monitoring countrywide. There are 17 air pollution monitoring stations through out the country. From the records attained from the stations, high levels of pollution are mainly in 3 stations of Gaborone, Selibe-Phikwe and Maun. The main sources of this air pollution are motor vehicles emissions, industrial dust and smoke from burning refuse as well as from wild fires. This division could play a very significant role of monitoring emissions of dioxins and furans from the various emission sources countrywide as some of these sources produce POPs. The Act therefore offers an important legislative tool to partly address issues of unintentional emission of POPs. Through the Act Botswana should be able to some extent generate information on emission of POPs locally and therefore help the nation understand the extent of POPs emissions in the country and from that information come up with strategies to tackle the problem.

In 1999 the National Assembly passed Agrochemicals Act to address the use and handling of agrochemicals in Botswana. The Act calls for the registration of all agrochemicals that come into the country. By keeping an inventory of all agrochemicals in the country it will be possible to know flows of dangerous chemicals that may have been banned from entering the country. It calls for labelling of all chemicals that one deals with and that entrepreneurs who deal in these chemicals have to be registered. Those dealing in these chemicals may be required to undergo training to capacitate them on chemicals handling. This would help in raising their awareness level and should help them advice their clients better as it has been shown that currently many of the clients who purchase chemicals do not get any or get very limited advice on safe handling of chemicals. However the act only addresses agrochemicals and therefore non agrochemicals are still not regulated through an Act.

The Ministry of Agriculture is undertaking a comprehensive training programme on safe handling of pesticides and best ways of disposing off empty containers. This awareness exercise has decreased the level of chemical containers that end up thrown on the environment as the return container arrangements are bearing fruits. This training Programme offers another opportunity to infuse information on POPs that can benefit the farming community and could even be extended to other stakeholders who use other industrial agents and those who deal with activities that produce POPs like dioxins and furans.

Implementation of policies and programmes is not only confined to government but is a concerted effort by all stakeholders including NGOs and other non state actors or civil society. The civil society also develops programmes aimed at promoting awareness on the environment. Their programmes are very much linked to the grassroots level projects implementation and have proved to be effective in building awareness at that level. Although there may be non at the moment that deal specifically with POPs, a number of environmental NGOs deal with awareness on the environment in general including waste management issues and sustainable management of natural resources. The Civil Society in most cases deal directly with communities and have managed to develop competencies amongst the communities on natural resources management. Due to this comparative advantage they have over government, the government should take them onboard in the implementation of the Convention.

The current setback in Botswana's Policies and Legislation is that they do not clearly address issues of awareness on a number of important issues such as POPs and other environment related issues. In areas where it is mentioned it is just in passing. The main issue especially with legislation is that most of them do not have regulations to spell out the specifics relating to issues of interest like POPs.

The major problem that government phases in the implementation of the Policies and Acts in place is resources limitation particularly human resources. This has greatly affected the extent to which these instruments could contribute to attaining the objectives of the various instruments.

The Environment Support Programme which is co-financed by Botswana Government and UNDP is currently developing a national database that will house all the environment related information that can be made easily accessible to those who need to use the information. This is meant to be a clearing house mechanism for environmental information. According to the proposal the ownership of the data will remain with the institution generating that data, what is being developed is conduit to link the various data bases so that the information is easily accessible to the end user. This should provide a very useful communication tool that those with information on POPs should take advantage of.

#### **2.3.8.4 Present public information tools and mechanisms**

There are several ways of disseminating information to the public including formal, non formal and informal systems. These encompass classroom settings, workshops, seminars, both broadcast and print media and traditional gatherings. Public awareness is mainly done through informal setting. For a wider outreach, awareness materials like brochures, posters, pamphlets, newsletters, articles in newspapers, television and radio programmes are employed. The government broadcast (television and radio) and print media (dailynews paper) run programmes for free and are easily accessible for information dissemination. The government also has a website where all Ministries post information relating to their functions and programmes. In addition to government information dissemination tools are those owned and run by the private sector, these include

mainly print media and websites and a couple of radio stations. These should be taken advantage of to promote awareness on POPs.

The government has established a number of public libraries throughout the country especially in towns and major villages. These libraries are meant to promote public access to information. Schools especially at secondary and tertiary levels also have libraries for students and teachers use. Within some government institutions, resource centres have been established for ease of access to information relating to that particular sector.

As a way of promoting consultations and participation in development processes, the Environmental Impact Assessment Act, requires developers to consult interested and affected parties of their intentions to undertake any project within their area of residence or operation that may affect them negatively or positively so that they become part of the decision making process. A developer is expected to give notice of 21 days prior to a consultative meeting. Within the notice it should be stated the type of project to be undertaken, expected benefits and negative impacts. The competent authority who implements the act has the powers to call a public consultative meeting if they feel thorough consultations with interested and affected communities have not been done.

Another instrument that can be used as information driver for POPs is the State of the Environment Report (SOER). The SOER aims to regularly provide information on the national status of the environment. The document is therefore a good vehicle for providing credible, comprehensive and science based information on the environmental conditions and trends including their significance. When reporting on the state of the environment, the reporting framework can be made such that it includes information on POPs. To enhance the reporting through SOER, the Ministry of Environment, Wildlife and Tourism is in the process of developing district state of the environment reporting framework to facilitate flow of information from the district level. The framework should make it easier to come up with a National State of the Environment Report from district reporting process.

#### **2.3.8.5 Assessment of environment as public priority**

A range of information dissemination tools are available for use, the suitability of the tools varies from target group to target group. The use of the various tools of information dissemination has its own advantages and disadvantages. The use of mass media such as broadcast media reaches out to a wider public but is disadvantaged by the limitation of affordability of items such as radios, televisions by individuals, families and communities. The use of print media also has disadvantage in that some people especially at grassroots level may not be able to read and write and the question of affordability of newspapers as well comes into play except where they are free. Development of awareness material like brochures, fact sheets and posters done in both official languages is useful and is encouraged. The advantage with such materials is that they can be kept for later use and reference when need arises and these are normally given free to the general public. The use of workshops encourages interaction amongst participants and resource persons and also gives an opportunity for interactive dialogue and better understanding of issues as one has a chance to ask where they do not understand, which does not happen very often in the case of broadcast and print media. Although direct contact through workshops and seminars seems to be the best tools, their disadvantage is that they are some times expensive to run and people may not always be available at the time they are called to attend. At the same time the cost limits the number of that can be reached.

Nowadays advancement in technology has made communication fast and easier with a wide body of information available through the internet. However the main disadvantage is that internet is

expensive and not readily available for many people within developing countries because electricity is not widely available and where it is, computers are not readily available and are unaffordable where available. All these problems make access to these tools a serious challenge for the government.

All the communication tools outlined above can be targeted to different groups of audiences according to suitability. This way it gives an opportunity to simultaneously use the available avenues to impart information to the public (Table 34).

**Table 34: Target groups and the suitable mode of communication for relaying information to them**

	<b>Print Media</b>	<b>Broadcast Media</b>	<b>Workshops/ Seminars</b>	<b>Kgotla Meeting</b>	<b>Awareness Materials</b>	<b>Written Documents</b>
<b>Educated</b>	✓	✓	✓	✓	✓	✓
<b>Semi-literate</b>		✓	✓	✓	✓	
<b>Illiterate</b>		✓	✓	✓	✓	
<b>Youth</b>	✓	✓	✓		✓	✓
<b>Women</b>		✓	✓		✓	✓
<b>Teachers</b>	✓	✓	✓		✓	✓

Nowadays it is difficult to have as many people going to traditional gathering places as they used to mainly because of commitments on other matters in their lives and some because it is no longer convenient for them. Women and youth are some of the groups that do not readily go to traditional meeting places and in cases where they do, their participation is normally very minimal. This therefore calls for other forms of outreach modes where they can be free to interact and fully participate in decision making processes.

### **2.3.8.6 Chemical contaminant and pollutant release public information programmes**

A number of big companies have departments dealing specifically with environment and safety in the work place, however it is still a concern with many of the small companies as this arrangement of fully flagged departments or units are not part of their structure. Issues of safety in the work place still lag behind and this puts many employees at a disadvantage in that they are not made aware of the dangers looming in their work places and how to avoid them. It is not only in companies that employees are not well informed on safety in the work place but some government institutions as well have limited awareness programmes for their employees. Majority of business and institutions rely more on on-the job training offered by people within and not engaging outside assistance as a way of cutting costs. The question is how effective and competent those doing the training from within are. From observation there is need for robust awareness raising campaigns and education programmes in most industries and offices. The Public Health Act however calls for serious consideration of issues of safety in the work place and if well implemented the Act would help raise awareness of workers on safe handling of items including chemicals some of which may turn out to be POPs.

There are very few formal programmes in place to raise awareness of stakeholders on issues of the environment in general. To address the issue of awareness raising on issues of the environment, there is currently a National Strategy and Action Plan developed and implemented countrywide by various stakeholders. Most of the awareness raising is done through workshops, seminars, production of awareness raising and education materials. Some institutions like the

Ministry of Agriculture have formalized systems of extension education through farmer training centres built through out the country to offer short term courses on matters relating to agricultural production both arable and pastoral agriculture. Through this arrangement the Ministry has taken a commendable step of teaching the farming community about safe handling of chemicals and proper disposal of waste emanating from the use of such chemicals. These education centres are some of the avenues that could be taken advantage of to raise public awareness on persistent organic pollutants.

#### **2.3.8.7 Mechanisms for information exchange**

To promote POPs information sharing between and among Parties, an arrangement of COP meetings is in place at which Parties report on their efforts and progress in addressing problems and issues relating to persistent organic pollutants. The information sharing can also be facilitated by the Convention secretariat through posting country POPs information on the website and correspondence to members on issues that need their attention.

The National Focal Point serves as a link for all stakeholders in the country by providing information as necessary to all stakeholders. The provision of information relates to that generated internally as well as internationally, so that interested persons are kept abreast of developments on issues of POPs. The National Focal Point therefore also acts as a link between the Convention Secretariat, other Parties to the Convention Secretariat and national stakeholders. A national committee comprising of various stakeholders with interest in the area of POPs has been established to direct and advise on the POPs and chemicals management in general as well as in the implementation of the Convention. Currently there is not much done relating to POPs information exchange particularly so because even the information sources at national level are limited.

#### **2.3.8.8 Survey Methodology**

The survey exercise covered several categories of stakeholders as follows; farmers, government offices, industry, general public and students. Out of the 6 agricultural regions, the following three regions were used for data collection, Central, North West and Southern. However in the analysis the Southern district was not included because a large percentage of the questionnaires were not responded to. The results reported on this category therefore are from Central and North West only.

Government institutions were widely covered through out the country including all the 10 administrative districts. The final survey was carried out in the Francistown area where industry and the public and students were included. In all the cases, respondents were asked questions (questionnaire) relating to the environment in general and POPs in particular and their responses recorded. In the analysis, the public and students categories were only included in determining the overall level of POPs awareness but excluded from individual category analysis because of the small sample size.

#### **2.3.8.9 Results**

Analysis of the survey data indicates that amongst the farmers interviewed in the Central and North West Districts 72.73% said general environmental information is not readily available while 25.45% said it was readily available and the remaining 1.82% did not respond to the question. Classified according to areas, the Central district had 90.32% respondents saying

general environmental information was not available while 6.45% said it was available and the remaining percentage did not respond. The North West showed a balanced response of 50% on the question. This wide difference between the two areas could be attributed to the fact that a good number of the North West farmers covered by the survey run their enterprises on commercial bases and are therefore likely to have more access to information sources that many of the small farmers in the Central District may not have.

On the question of awareness on POPs, 74.58% of the farmers did not know anything about persistent organic pollutants while 25.42% said they knew about POPs. The remaining percentage did not respond to the question. Farmers category response to the question of accessibility to information on safe handling of chemicals showed that 52.73% had access to such information and 10.91% had no access to the information.

The survey also revealed that majority of the farmers interviewed had general knowledge on chemicals management especially pesticides. This may be attributed to the ongoing awareness programmes mounted by the department of Crop Production to sensitize farmers on the need for proper handling and management of the chemicals they deal with in their farming enterprises. This is one programme that could be taken advantage of to promote POPs awareness countrywide.

The other categories in the study included the following; government employees, industry. The responses from these other categories were also presented as grouped or categorized. The industry results show that 53.33% of respondents knew about POPs and 46.67% did not have any idea what POPs are. Amongst the government category, 62.26% knew about POPs while 37.74% did not know about them. When grouped together, the groups average on awareness on POPs showed that 43.26% were aware while 56.74% were not aware. The differences observed amongst the groups can be attributed to the fact that most of the government employees interviewed are working for public health institutions and therefore familiar with chemicals, through work experience as well as through professional training. The large number of respondents from government with knowledge on POPs may give a distorted picture of the real situation on the ground because from other categories it is clear that awareness on both POPs and general environmental issues is low. Even amongst many of those who responded positively to the question of POPs knowledge, on further discussing the issue it came out clearly that many did not make distinction between non POPs chemicals and POPs. On many occasions many may have indicated that they were aware of POPs while in actual fact they did not know. Furthermore some of those who knew about POPs did not fully understand the dangers posed by using them. Amongst those that did not know about POPs were those in the business of selling different kinds of chemicals such as for termites control, those used for crops and livestock and many others including those selling paints.

Responses to the question of access to information on safe handling of chemicals revealed the following; government employees group had 47.17% saying they had access while 41.51% said they did not have access to such information. Farmers' category had 49.15% of the respondents saying they had access while 10.17% indicated they did not, the remaining percentage did not respond to the question. The industries category had 66.67% with access to information and 6.67% with out information, like in the farmers category remaining percentage did not respond to the question.

The other area that was considered was employee awareness programmes on chemicals or POPs. The government category had 30.19% indicating that they had awareness programmes for employees while 62.96% did not have any awareness programme. Farmers category had 50.85% with programmes for employees and 15.25% with no employee awareness programmes. The third category of industry had 53.33% responding positively to the question and 26.67% saying they

did not have any programmes. In the case of farmers, the programmes they referred to were those offered by the Ministry of Agriculture and not organized by farmers themselves.

Asked whether there were any precautionary measures in place at work, the farmers category had 35.59% of respondents saying there were measures in place while 15.25% said there were no measures in place and the rest did not respond to the question. Government category had 67.92% with measures in place and 13.21% without. The industries category had 53.33% with measures in place and 26.67% without any measures.

From this survey, it is clear that people's knowledge on POPs is low and the way chemicals are handled at work places leaves much to be desired which poses a serious threat to the health of those handling them. Should they come in contact with POPs in the process of handling chemicals it would easily affect them. Although in some cases protective clothing is supplied to the working force it is not always used effectively. On many occasions workers handle the chemicals without protective clothing. In some cases the type of clothing provided is not appropriate to protect against the chemicals being handled. Further more the industries selling chemicals hardly provide any advice on the best ways of handling chemicals to their customers. However this is not surprising since majority of the suppliers do not know much about chemicals and POPs as observed during the survey. It was only on one occasion where there was a chemicals dealer who had items labelled nicely and signs of chemical danger signs displayed in the premises. The workforce also attested that the management trains them on safe handling of chemicals so that they can also explain to their customers the need to handle chemicals safely.

### **2.3.9 Relevant activities of non-governmental organizations**

#### **2.3.9.1 Summary**

The term NGO is used in a variety of ways all over the world and depending on the context, in which it is used, can refer to many different types of organizations. In its broadest sense an NGO is not directly part of the structure of government, making it an integral stakeholder in participatory decision making processes.

General functions of NGOs are to notice immediate needs and respond to them. This could include building capacities for local communities to meet their needs through self-reliant local action, or advance changes in policies and institutions at local, national and international level; by moving away from operational service providing role, towards a catalytic role.

NGOs mobilize public support and voluntary contributions for aid, often having strong links with community groups in developing countries and often work in areas where government-to-government aid is not possible. But they are generally accepted as part of the international relations landscape, and while they influence national and multilateral policy-making, they are increasingly more directly involved in local action.

Botswana is signatory to several international treaties, among which is the Stockholm convention on the Persistent organic pollutants (POPs). Article 7, paragraph 2 of the convention facilitates 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 implementation plans.

Non-governmental Organizations and Community-Based Organizations in Botswana are affiliated to two major organizations namely BOCONGO and BOCOBONET respectively. These are the umbrella bodies that keep databases concerning networking and information

dissemination, capacity building and training and providing an enabling environment for affiliates.

However, there are still a couple of other NGO's that are not affiliated to either of the umbrella bodies, but just operating under the registrar of societies.

Research has shown that many organizations that there are two ways in which organization are involved in the use of POPs. Direct involvement concerns those organizations that have hands on activities that concern application of these chemicals to their projects, storage or sale. Indirect involvement concerns those organization that offer public awareness and theoretical research on the field of POPs or hazardous chemicals.

### 2.3.9.2 Introduction

This Chapter focuses on the current activities done by NGOs and CBOs in Botswana concerning the use, storage and awareness of POPs or hazardous chemicals. BOCONGO and BOCOBONET as umbrella bodies of the mentioned organizations, have both issued lists of their members that are actively involved in the use of organic chemicals. This chapter examines the extent to which the said NGO/ CBOs are involved in the POPs status in Botswana.

Bocongo classifies organizations that deal with Agriculture, Environment, conservation and education under Environment and Agriculture sector. This group enlists a number of Organizations that are of interest to this chapter. This list encompasses those organizations that have projects linked to the use (Agriculture) through pest management practices and environmental protection through public awareness education on chemical usage.

There is however another set of non-governmental groups that are not affiliated to BOCONGO or BOCOBONET that practices farming activities, which have been analyzed and outlined in the Table 35 below. Most of the products used concern pest management activities.

**Table 35: Relevant NGOs in the field of environment and chemicals management**

Name of NGO	Contact details	Relevant activities	Additional Expertise	Comment
Somarelang Tikologo (ST)  E, C, P	P O Box 00376 Gaborone Tel: 3913709 Fax: 3913709 Email: <a href="mailto:st@somatiko.org">st@somatiko.org</a> <a href="http://www.somatiko.org">www.somatiko.org</a> .bw	Demonstrations through Organic garden, creates awareness on alternatives to chemical pest control. Formulation and Development of Tshole Trust (a waste oil management NGO) Development of Educational materials.	Environmental campaigns Waste management Public awareness Research Advocacy	It has the capacity to do research, demonstrations and carryout public awareness and educational activities, and waste management demonstrations.
Tshole Trust (TT)  E,C,P	P O Box 00376 Gaborone Tel: 3915140 Fax: 3915140 Email: <a href="mailto:tshole@info.bw">tshole@info.bw</a> <a href="http://www.tshole.info.bw">www.tshole.info.bw</a>	Waste oil collection points. Public awareness about extent of environmental contamination and degradation caused by waste oils and hazardous chemicals	Public Environmental Education through campaigns. Provision of infrastructure for disposal of waste oil.	Capacity to provide awareness on hazardous chemicals handling and POPs, and provide infrastructure for storage.

Name of NGO	Contact details	Relevant activities	Additional Expertise	Comment
Kalahari Conservation Society (KCS) E	P O Box 859 Gaborone Tel: 3974557 Fax: 3914259 Email: ceo@kcs.org.bw www.kcs.org.bw	Capacity building for NGO's and CBO's in southern Africa. Research.	Environmental campaigns and education.	Has capacity to organize training workshops on environmental issues, and do research.
Cooperation for Research Development and Development (CORDE) C	P O Box 1895, Gaborone Tel: 3923865 Fax: 3923971 Email: eds@it.bw	Enterprise development (Agriculture, Manufacturing, Art and Craft) Have 5 projects sites under their office, located in Serowe, masunga and mochudi.	Mobilization of communities around economic activities through participatory methodologies	Wide coverage, and extended fields of services.
Mmegi Publishing Trust E C P	Private Bag BR298, Gaborone Tel; 3952464 Fax: 3184977 Email: mmegi@it.bw	Media coverage, broadcasting and publications and educational campaigns.	Journalism expertise	Have the capacity to cover any topic and disseminate it electronically and other wise, across the country.
Botswana Council of Non Governmental Organizations (BOCONGO) ECP	Private Bag 00418 Gaborone Tel: 3911319 Fax: 3912935 Email: bocongo@bocongo.org.bw www.bocongo.org.bw	Capacity building for NGO sector for sustained development and service provision.	Research, publication and documentation. Networking and records of NGO's for information dissemination	It has capacity to conduct research on a subject matter and provide training to its affiliates.
Botswana Community-Based Organizations Network (BOCOBONET) ECP	Private Bag B0166, Bontleng Gaborone Tel: 3185081 Fax: 3185081 Email: bocobonet@mega.bw	Capacity building for CBO sector for sustained development and service provision. Boasts of 83 member but only 6 have horticultural projects.	Networking and records of NGO's for information dissemination	It shall be useful in information dissemination and extension of geographic coverage across the country and provide training to CBO's.
Permaculture trust of Botswana (PTB) E	Rasebolai Post Office P O Box 31113 Serowe Tel; 4632428 / 4634398	Demonstration projects – organic farms and Gardens.  Location of projects: Serowe, Ghanzi, letlhakane, new xade etc.	Provision of extension support and training on farming activities Permaculture Design Techniques Community Mobilization Conservation of land race species Community-based natural resource management	It to avail information on alternative methods of farming and garden to a wider geographic coverage.

Name of NGO	Contact details	Relevant activities	Additional Expertise	Comment
Botswana Horticultural Council C, P	P O Box 25324, Gaborone Tel: 3936357 Fax: 3937888 Cell: 71202072	Demonstration projects – farms.	Horticultural experts	Have capacity to Display technology or alternative technology to conventional chemical intensive farming. Linked to government services i.e. advised by govt Agriculture officers.
Veldt Products research and development E	P O Box 2020 Gaborone Tel: 3947047 / 3947377 Fax: 39473363 Email: veldprod@info.bw	Community based projects, organic agro forestry, nurseries and orchards	Research and horticulture.	Have capacity to research on indigenous knowledge and practices in agro forestry.
Forestry Association of Botswana. E	P O Box 21456 Gaborone Tel: 5998901 /2 Fax: 5998018 Email: <a href="mailto:fab@info.bw">fab@info.bw</a>	Organic botanical gardens in Kumakwane, agro forestry.	Research and horticulture	Have capacity to research on indigenous knowledge and practices in agro forestry.

The method of data collection adopted for this chapter relied on existing secondary data: **1)** A list of Environmental NGO's from the National directory of Environmental NGO's (2003); **2)** Bocongo Directory (2007/8); and **3)** updated versions of membership lists from Bocobonet. Confirmation on existence of these organizations was done by telecommunication with heads or executive directors of each member institution. This method was chosen based on its reliability and validity.

The telephonic interviews included confirmations on the current mandates of the organization, which were done to assert that mandates have not changed. This was followed by a questionnaire fax for key informants to 6 institutions, which the researcher felt, were of critical relevance for this exercise. This however proved to be cumbersome on the interviewees. No response was received within the stipulated time frame of five days, which then compelled the consultant to adopt another methodology. The questionnaire was administered in an attempt to further validate findings in a recordable manner.

The last chosen methodology entailed a one on one interviews with key informants at each of the 6 chosen institutions. The data required was meant to depict the true picture of the current status on the use or information dissemination about hazardous chemicals, POPs or on environmental conservation and management.

The research has revealed quite an insignificant use of POPs/Chemicals by CBO's/NGO's. Of the 10 selected NGO's that are on the environment-Agriculture sector only 2 NGO's i.e. the farmers association (Botswana Horticultural Council and BOCOBONET) use regular pesticides and fertilizers. These organizations are the umbrella bodies of farmers across the 6 regions of the country. However these chemicals are approved by the ministry of Agriculture (plant protection unit) even the disposal of containers regulated by the same unit through the extension staff.

### **2.3.9.3 NGO's input in the implementation of POPs convention at the national and international levels.**

Non-governmental Organization continues to seek gaps where they can play a significant role in addressing community needs. Agricultural organization like farmers associations practice farming methods that encompass the use of pesticides and organic fertilizers. The current study, which was done by the Department of Environmental Affairs in conjunction with the Ministry of Agriculture (Plant Protection Unit) on farmers, revealed a positive result on the use of these chemicals with significant hazardous similarities to Persistent Organic Pollutants. A POPs awareness seeking pilot study was administered to farmers in Kgatleng district, which later revealed lack of knowledge, low awareness levels and a positive indication that pesticides were used.

However, the study could not be concluded to reveal to what extent is the status of POPs usage and labelling by retailers mislead people and lack of enforcement/ guiding tool exacerbated the problem.

Environmental NGO's like Kalahari Conservation Society (KCS), Tshole Trust and Somarelang Tikologo have projects that deal with raising awareness about environmental issues. The component of public and environmental education on each of this organizations encompass environmental campaigns that raise awareness about the need reduce the use of POPs related chemicals Figure 43.



**Figure 43: Indiscriminate chemical disposal**

### **Case study 1**

Somarelang Tikologo has in the past 5 years been practicing organic gardening, which aims at sensitizing the public about the need to adapt environmentally friendly methods of farming. The organic garden uses natural substances like pepper for pest management and kraal manure, ash and composting to enrich its soil contents. The project is currently based in Gaborone but it is widely broadcast over national media. The current plan is to expand it to urban poor locations through the assistance of United Nations Development Programme – Global Environment Fund Small Grants Program (Figure 44).



**Figure 44: Promoting organic gardening**

### **Case study 2**

Tshole Trust offers environmental education on waste oil management. Waste oil is an organic pollutant which is of particular concern. Tshole Trust raises awareness about the extent of pollution that can be caused by a drop of used lubricant to underground and surface sources of water, even to human health, and the impacts of such pollution on the economy at large. This trust also provide infrastructure for the collection of waste oil, which is placed strategically on the national grid. The oil industry operating in Botswana supports this trust to achieve its mandate (Figure 45).



**Figure 45: Tshole Trust provides infrastructure for the public to dispose off waste oil**

**How NGO's in Botswana promote public participation in addressing environmental, chemical issues and POPs issues and their health and environmental effects.**

NGOs promote public participation through voicing public concerns. Consultation is usually the first strategy to be implemented; it is used to gauge public opinion on different issues. The

consultations are through meetings, which can be held in different forums, like the use of traditional setups (kgotla), or modern setups of workshops, panel discussions, and debates. Other forms include the use of media like radio, television and newspapers. Place and timing of this process remains at the convenience of communities and non-discriminatory measures are adopted. Freedom of expression liberates community members to air their views.

The public should have a say in decisions about actions that affect their lives and the current activities done by NGO's are guided by the following principles:

- Public participation includes the promise that the public's contribution will influence the decision.
- The public participation process communicates the interests and meets the process needs of all participants.
- The public participation process seeks out and facilitates the involvement of those potentially affected.
- The public participation process involves participants in defining how they participate.
- The public participation process provides participants with the information they need to participate in a meaningful way.
- The public participation process communicates to participants how their input affected the decision.

Common programmes that mobilise communities to interact in this aspect include environmental campaigns, commemoration days, workshops, inducting Environmental impact assessment processes and demonstration projects.

#### **2.3.9.4 NGO and Government relationship**

In some countries, NGOs are major contributors to development processes. This is not uniform, however. In a number of countries, NGOs are weak or play more of an oppositional rather than operational role and governments are highly suspicious of them. A number of factors influence the development impact of NGOs; many of which are determined by the relationship between the NGO sector and the State.

The principal avenues by which governments can influence the operational environment for NGOs are:

- Factors of governance (encouraging public debate and consultation, and the right to organize interest groups);
- NGO regulations and the legal framework (for example, regarding registration and reporting, auditing and accounting requirements);
- NGO incentives (including taxation policies on income or local fund-raising, duties on imports, subsidies for NGOs, etc.);
- Collaboration (use of NGOs in program/project implementation);
- Involvement in policy-making (serving on committees, assisting with public consultations);
- Public disclosure of information (NGOs serving as a conduit to inform the public about development schemes which effect them);
- Coordination requirements within the NGO sector; and
- Direct expenditure, including official support (grants, contracts, etc.), and research benefiting the NGO sector.

In Botswana the current scenario guided by the above instruments, is that NGO's more or less enjoy a healthy relationship with the state. Factors of governance are relaxed, regulation is not stiff and NGO's are free to seek funding wherever possible using their own methodologies that do not infringe the common law, ministry departments avail funds that are accessible through proposal writing of viable/ sustainable projects. National projects teamed up with international organization always offer NGO involvement through consultations for input and at times can outsource few activities to be implemented by civil societies. This kind of a relationship is more noticeable in the health sector, where AIDS NGO's enjoy massive support from the government to serve as an outreach programme to the beneficiaries. NGO's in Botswana are viewed by the public and private sector as development partners.

However, it is advisable to note that the state-NGO relationship should not be too comfortable. In such a situation NGO's tend to accept uncritically both the government's information and the government's role in coordinating all development activities, including those of NGO's. In this case NGO's will be largely content to fill gaps as directed but the authorities rely on such commissions for survival. They do not question state activities, and therefore fail to inject the grass roots perspective. A degree of financial autonomy of the NGO sector is necessary to ensure their independence.

#### **2.3.9.5 Challenges faced by environmental NGO's in implementation of projects or fulfilling their mandates.**

In Botswana, as in many developing countries the environment has still not been given its deserved status vis-à-vis other budgetary priorities. Botswana is a late starter on environmental conservation and management strategies, Environmental NGO's have therefore taken a lead in lobbying for environmental protection. Despite commendable progress on issues dealing with environment at policy level, environmental NGO's continue to suffer in attracting funding support. Though governance wise the government is more supportive, the environmental sector is not given enough precedence where its due. More so, operating on this field has become difficult since the re-classification of Botswana to a middle income country has made international funding hard to attract, and many environmental NGO's closed as a result of this. The current operational ones still site the same problem of lack of funding support as the major threat to their survival.

Many civil society organizations are over-stretched. They operate on a task-to-task, day-to-day basis. Often, it is hard enough keeping organizations going let alone having to find the extra time to promote them. This approach, although perfectly understandable, is not ideal. It could even lead to organizations closing down.

Other common challenges include:

- Poor management of NGO's due to less attractive packages,
- Poor staff retention due to funding constraints
- High staff turn over
- Lack of an effective fundraising strategy.
- Lack of project monitoring and evaluation processes/methods.
- Lack of promotional and marketing strategies.
- Donor fatigue caused by a limited pool of donors
- Limited resources making operations impossible to achieve
- Over reliance on donor funding.

### **2.3.10 Overview of technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, management, research and development – linkage to international programmes and projects**

#### **2.3.10.1 Introduction**

Botswana is signatory to the Basel Convention which provides for control of transboundary movement of hazardous wastes. The Waste Management Act on the other hand provides for among others planning, facilitation and implementation of advanced systems for regulating the management of controlled waste, including transboundary movement of hazardous waste. In pursuit of the above, the Department of Waste Management and Pollution Control in collaboration with Ministry of Local Government has established facilities for assessment, measurement and analysis for such wastes.

#### **2.3.10.2 Waste disposal capacity**

Currently there are twelve landfills, but none of them accept hazardous wastes. This is because they do not have hazardous waste storage treatment in place. Hazardous waste is taken to South Africa for incineration. The Ramotswa landfill has a small, temporary holding for this waste, before it is shipped to South Africa.

#### **Current national capacity in managing PCBs**

The landfills in Botswana are not designed to accept PCB contaminated waste, as it was stated earlier. Similarly, incinerators are unable to treat PCB contaminated waste. There are no dedicated sites for storage of transformers, there are however temporary measures that may not be environmentally compliant. Some laboratories are available to analyse for PCBs, for example the National Environmental Lab owned and operated by the Department of Waste Management and Pollution Control. The University of Botswana is also capable of PCB analysis.

#### **Obsolete pesticides storage sites**

Obsolete pesticides and empty containers have a central storage i.e. Sebele, however there are no facilities to dispose of pesticides in an environmentally sound manner. The pesticides are usually exported outside the country, but this has proved to be an expensive exercise and such is not done accordingly. Collection from farmers has been progressing slowly because the storage facility has reached its capacity.

#### **Treatment facilities**

There are no hazardous waste treatment facilities in Botswana, almost all landfills have incinerators, but they are at the moment not able to treat such waste.

#### **Capacity and costs**

Exporting waste outside the country is costly, although figures may not be provided at this stage. Establishing a facility in the country will not only reduce the associated costs, but will build capacity in the country. It is envisaged that future landfills will have facilities to deal with hazardous wastes and capacity building in this area will be necessitated.

#### **Contaminated Sites Remediation Capability**

Botswana does not have specialized service facilities for biological soil treatment, transportable treatment technology, specialized thermal, physical and or chemical soil decontamination capability. In dealing with remediation emanating from emergencies and unintentional introduction of hazardous waste into the environment, the Polluter Pay Principle, which is embedded in the Waste Management Act is applied.

### 2.3.10.3 Environmental monitoring capability

Botswana has a number of government laboratories, the National Environment Laboratory, Geological Surveys Laboratory, Waters Affairs Laboratory, Veterinary Laboratory and Agricultural Research Laboratory. Among these the National Environmental Laboratory and the Geological Surveys Laboratory have the Gas Chromatograph coupled with Mass Spectrometer (GC/MS). The GC/MS is limited in terms of resolution and as such it is limited in terms of analysis. The University of Botswana has both the equipment and technical expertise to monitor and analyze for POPs i.e. High Resolution GC/MS. There is a close collaboration between the Environmental Lab and the University Chemistry Lab. Capacity; especially human resources to monitor and analyze samples for pollutants is limited within the government, however efforts were made with the assistance of UNIDO to train one officer from the DWMPC. The table below (Table 36) shows the available infrastructure with the capability to analyze for POPs.

**Table 36: Technical Infrastructure, equipment and capability**

Institution	Type of lab	Equipment	Personnel	Capability for pops analysis	Frequency of monitoring	Methods
Geological Surveys	Environmental lab	GC-MS	2 chemists, 3 technicians	still training on use of GC-MS and method development	new development	not known
UB	Academic research	HRGC HRMS GC-MS	> 10	capable	on research basis	not known
DWMPC	Environmental lab	GC-MS	5 chemists, 2 technician	technically capable for both sampling and analysis (low resolution GC-MS)	not being done due technical faults	USEPA method 23

### Standards for monitoring activities

Some of the national standards are not yet developed, Botswana currently uses WHO standards. This is an area that is still under development.

Botswana does not have support services in accrediting laboratories and methods. This service is mainly provided from South Africa (SANAS). The National Environmental Laboratory is currently in the process of getting accredited.

### 2.3.10.4 Health monitoring capability

Currently Botswana lacks Public health laboratories for monitoring human health impacts for exposure to POPS. This lack of infrastructure hampers research activities related to the convention. Meanwhile the University Of Botswana, faculty of medicine has a plan to develop the School of Public Health, which will work hand in hand with government. Regional linkages such as Medical Research Council of South Africa have been explored for assistance with analysis of samples in some research areas but because of its capacities limited to South Africa we can not hope to be relying on their assistance.

#### **2.3.10.5 Technical support and release mitigation services**

There are limited periodic environmental or health audits, cleaner production studies undertaken in Botswana, in cases where they are undertaken; it is as a reactive measure to an outbreak of insects. This is attributed to the lack of technical infrastructure and human capacity.

### **2.3.11 Identification of impacted populations or environments, estimated scale or magnitude of threats to public health and environment**

#### **2.3.11.1 Management of chemicals in the workplace**

The health and safety officers have the powers under the Factories Act to ensure that chemicals that are manufactured, used, handled, stored and packaged are controlled and managed in a manner that does not impact negatively on the health and safety of the worker and the environment by;

- Conducting health and safety inspections of the workplaces for purposes of discovering unsafe or unsatisfactory conditions and practices and to ensure by all practicable means the observance of health and safety standards.
- Examining architectural and technical drawings of proposed plants or modifications in order to identify lacking safety and protective measures such as isolation of dangerous processes, ventilation, barriers, placement of hazardous substance, storage and other aspects.
- Checking the provision of exhaust systems, ventilation and other devices for the removal of hazardous substances and agent form the work environment.
- Prescribing control measures that should be implemented to prevent chemical hazards at the source in order to improve the quality of work environment and prevent diseases or impairment to health, and monitor the application of such measures.
- Recommending medical examination for workers in any place where exposure has been found to be excessive
- Conducting training for workers to read and understand safety information on chemical containers, health hazards and route exposure.
- Training workers on how to handle dangerous substances and processes with respect to planning, developing and choosing the safe working procedures and also understand the emergency procedures
- Encouraging formation of a Safety Committee in industries with the task of working regularly with safety and health issues.

### **2.3.11.2 Chlordane**

Although chlordane is imported into the country for use in buildings to control termites, households get access through wares houses and use it for termites. The users and or importers of any household or industrial chemical are required to fill in a material safety data sheet (Environmental Health Division), which provide conditions on storage, use and disposal of such substances. At the household level proper regulations, especially on administering of the compound may not be followed, since the labelling may be too technical or little attention given to it. At this level there maybe likelihood that the chemical may not be used or disposed off incorrectly and as such pose a health risk. The impacted populations are mainly constructors, and the extent could not be determined at this stage, since the chemical is used on ad-hoc basis.

### **2.3.11.3 DDT**

The spraying of DDT in Botswana has been discontinued since 1997, and as such the impacted populations may not be determined, however there maybe residuals pollutants in the environment that will need to be investigated further. The spraying of DDT has in the past involved various stakeholders such The Department of Environmental Affairs, Department of Waste Management and Pollution Control.

### **2.3.11.4 Dioxins and Furans**

Dioxins are mainly produced from waste incineration and uncontrolled combustion, (mainly from landfills, waste burning, accidental fires and others), with the former producing the highest amount per annum (i.e 70% of total emissions). From the inventory of unintentional releases (Annex C POPs), the number of establishments surveyed which have the potential to release these chemicals is twenty four (24), sixteen (16) of which are in hospitals and clinics and eight (8) in landfills. In most cases waste incinerators are operated by one person, although the number above i.e 24 does not represent all establishments in the country. However the pollution produced from the incinerators affects people in the vicinity, such as employees of the establishment and populations close-by. It is however important to note that from the inventory it was realized in most cases (more than 50%) of the operators are not trained in operating the facilities, and may not follow the procedures of minimizing the health and environmental impact arising from such. The ash in most cases is disposed of at landfills with all other domestic waste. It is difficult to estimate the number of populations affected by the release of these chemicals

### **2.3.11.5 PCBs**

The exposed populations to PCBs contamination from the electrical utility (BPC), include those in the maintenance sections, which account for about 55% of the total workforce, approximately 1000 people. Those are either responsible for maintenance, construction and disposal of transformers.

## **2.3.12 Details of any relevant system for the assessment and listing of new chemicals**

### **2.3.12.1 Introduction**

Article 3 paragraph 3 of the Convention states that:

*“Each Party that has one or more regulatory and assessment schemes for new pesticides or new industrial chemicals shall take measures to regulate with the aim of preventing the production*

*and use of new pesticides or new industrial chemicals which, taking into consideration the criteria in paragraph 1 of Annex D, exhibit the characteristics of persistent organic pollutants.”*

In general chemical management and regulation in Botswana is not effective due to lack of coordination among all sectors that deal with chemicals. These range from importers/retailers, industries, government departments and others. The management is done through a number of existing legislation and policies.

Due to the economic diversification drive and improvement in the agricultural sector, there has been a marked increase in the import of chemicals into the country. Most chemicals are mainly used in the agricultural industry, manufacturing and mining and are imported due to the fact that the country doesn't have major chemical manufacturing industries.

Most of the country's chemical concerns are as a result of economic growth as earlier stated, and attempts have been made to address chemical concerns through Policy, Legislation and other instruments such as:

- The National Conservation Strategy of 1990;
- Atmospheric Pollution (Prevention) Act (1971)
- Public Health Act,( currently repeal)
- Chemical Products and Substances( bill)
- Waste Management Act 1999
- Waste Management Strategy 1998,
- Agrochemicals Act 1999,
- Wastewater and Sanitation Management Policy (2001) and
- Environmental Impact Assessment Act of 2005.

As these policies and legislation are housed within different departments or institutions, through the above instruments, these institutions e.g. Department of Agriculture, regulate and assess the stocks of chemicals in the market or in use within the country.

In addition to the above, a draft Chemicals Management Bill is being promulgated. The Environmental Management Act is also at the Bill stage and it is envisaged that once the act is in place, the different legislation and policy on environmental protection, including chemical control will be better coordinated for effective implementation. Over and above these regulations and policies, in an effort to further foster international collaboration in environmental protection, control and regulation chemical related substances, the country has also ratified the Basel Convention on Trans-boundary movement of Hazardous Wastes and other related conventions.

#### **2.3.12.2 Existing regulatory schemes and processes for assessing new chemicals.**

The regulation of industrial chemicals is a mandate for Ministry of Health in, Environmental and Occupational Health Division. The promulgation of the legislation dealing with industrial chemicals was the outcome of a stakeholder recommendation about the need to regulate the industrial chemicals some which include POPs. However because of the lengthy legislative process in the country and pressing priorities of the need to legislate in other areas of health the process has been delayed. The proposed Chemicals Products and Substance Bill is currently in its drafted format and has been given the priority for this financial year.

However some interim measures are in place while the legislative process is being delayed. Currently the Division is responsible for giving clearance on health and environmental effects to chemical importers in conjunction with the Department of Trade and Licensing. The assessment

uses the Material Safety Data Sheet (MSDS) and at times the Division makes reference to the database (inventory) that was developed during the project. The Inventory has a list of chemicals that the legislation is going to regulate but, since the delay in the enactment of the new legislation, the Division has proposed the revamping of the inventory. The Division has also come up with the Classification and Labelling Standard for Chemicals (BOS 62) which is of use to industry for health, safety and environmental purposes. The major setback has been the formulation of the Act because most of the actions planned such as; being a sole inspectorate authority presiding over matters of industrial chemicals, inventory set up and its use for regulation and aspects such as training, and adopting the standard (BOS 62) as mandatory .

The Division continues to clear and register chemical importers and on average up to thirty clearances are issued per month. This gives a clear picture that a lot of chemicals are being brought into the country but inadequacy of legislation is hampering the best practices for managing them in an environmentally responsible manner. Concern lies on the fact that the country has ratified the Multi Lateral Environments that deal with the proper management of chemicals that includes POPs. The Division also continues to educate the public and industry on the safe use of household chemicals. Advocating for prioritising the enactment of the chemicals legislation will be a breakthrough area which can be achieved through the coordinating agency (DEA).

### **2.3.12.3 Regulatory schemes and processes for assessing new pesticides.**

The current system for assessing new pesticides is found under the Agrochemicals Act 1999. Ministry of Agriculture Plant Protection Division is the authorised body, where the application should be filed. The application should contain information on the

- A description of the pesticide giving its trade name, the common name, the active ingredient, other ingredients, its chemical name and concentration;
- The name and address of the manufacturer, packager and supplier
- The purpose for which the registration is sought;
- Toxicological data, including material safety data sheets, efficacy trials and environmental or health reports and the safe periods after application of the pesticide:
- A statement as to whether the pesticide is banned or severely restricted in the country of origin or of packaging due to health or environment reasons;
- The proposed draft label for the storage, sale or supply of the pesticide;
- Proposed method of storage of the pesticide; and
- Intended method of disposal of the pesticide and its container if so required due to surplus or expiry date for use.

The National Agrochemicals Committee, which meets not less than three times a year, decides on the application. Upon favourable decision, the registration is provided for 5 years. After five years the application should be re-submitted.

The registration process started in 2006. During the registration process paragraph one of Annex D is not taken into consideration.

### **2.3.13 Details of any relevant system for the assessment and regulation of chemicals already in the market**

#### **2.3.13.1 Introduction**

Article 3 paragraph 4 of the Convention describes that:

*“Each Party that has one or more regulatory and assessment schemes for pesticides or industrial chemicals shall, where appropriate, take into consideration within these schemes the criteria in paragraph 1 of Annex D when conducting assessments of pesticides or industrial chemicals currently in use. “*

#### **2.3.13.2 Existing regulatory schemes and processes for assessing chemicals already in the market**

Currently the regulatory scheme for industrial chemicals involves assessment of chemicals that are in the inventory. However the limitation of the lack of back up of the legislation has caused a setback in consistently carrying out the inventory assessment process. The review of the Act should consider the criteria in paragraph 1 Annex D.

#### **2.3.13.3 Regulatory schemes and processes for assessing pesticides already on the market.**

The Agrochemicals Act established the Registrar. All registered agrochemicals are included in the registrar. There are no regulatory schemes or processes for assessing pesticides that are currently in use in the country. The registration process was initiated in 2006 and so far paragraph one of Annex D to the Stockholm Convention is not taken into account during the revision of the registrar.

### **3 STRATEGY AND IMPLEMENTATION PLANS ELEMENTS OF THE NATIONAL IMPLEMENTATION PLAN**

#### **3.1 POLICY STATEMENT**

The Government of Botswana committed itself to the Stockholm Convention on Persistent Organic Pollutants (POPs) and would abide as far as practicable to the obligations of the Convention through its ratification on the 28th October 2002.

Recognising the central role of the national environmental policies and sustainable development policies to the country's development, the need for attainment of Agenda 21 targets and the need to integrate the POPs issues and implementation of the NIP within this national policy as guided by the national vision; Vision 2016,

Recognising that the NIP is the outcome of close consultation between relevant government ministries and departments, and the relevant NGOs, parastatals and the private sector,

Recognising that the successful implementation of the Convention and the NIP will depend on assistance from international as well as local government, non governmental and private partners,

The Government of Botswana endorses the National Implementation Plan (NIP), and commits itself to its implementation subject to adequate assistance. The endorsement letter is attached as Annex 1.

The Government also commits itself to place the POPs issue and the NIP within the overall national policy and legislative framework relating to environmental protection, sustainable development, public health and agriculture.

#### **3.2 IMPLEMENTATION STRATEGY**

##### **3.2.1.1 Overview**

Botswana ratified the Stockholm Convention on Persistent Organic Pollutants (POPs) on the 28th October 2002. The Convention's objective is to protect human health and the environment from persistent organic pollutants. Ratification meant that Botswana fully commit itself to the Convention, and also launched the development and implementation of the NIP.

Some of the key elements of the treaty include:

- That developed countries provide new and additional financial resources.
- Individual governments put in place control measures to eliminate production and use of the POPs.
- Individual governments eliminate intentionally produced POPs and their wastes in an environmentally sound manner.
- And substitution of POPs with safer chemicals and processes to prevent toxic by-products.

The NIP concept fits well into the long term vision of the country, i.e. Vision 2016. The vision seeks to provide guidance to development policies and programmes that promote sustainable management of the nation's resources to attain the ultimate objective of sustainable development.

The NIP will also inform the government and its partners of the national priorities for action at determined times as per the action plans. This process/concept also fits well within the national development process of Botswana as is defined in the country's National Development Plan (NDP), District Development Plans (DDPs) and Urban Development Plans (UDPs).

Similar to other multilateral environmental plans and strategies (e.g. National Action Programme of the UNCCD), its implementation will be merged into the national plan of implementation of the multilateral environmental agreements as spelt out in the draft Multilateral Environmental Agreements Implementation Strategy.

### **3.2.1.2 The NIP preparation process**

The process of inventorying POPs in Botswana started in 2004. This process eventually led to the development of the NIP, to guide the convention implementation as stated above.

This involved the establishment of a multi disciplinary stakeholder committee consisting different Government departments to steer the implementation of the Convention. This committee was also tasked with guiding the inventorying process undertaken by the task teams from four (4) thematic areas of:

- Pesticides and Contaminated Sites
- Legal, Institutional and Technical Capacity
- PCBs, Dioxins, Furans
- Education and Awareness Raising

### **3.2.1.3 NIP Implementation Objectives**

The main objective of the NIP is to meet the requirements of the Convention within the stipulated deadlines. Each action plan within the NIP details the relevant convention requirements. The NIP document also defines country's commitments, current situation and the action that it intends in respect of the management of POPs. The specific objectives are: -

- To provide the documented demonstration of what a country intends to do in response to the obligations set out in the Stockholm Convention on POPs as required in Article 7 of the Convention;
- To gain eligibility status for international financial assistance;
- To provide a national policy instrument and framework within which POPs issue is to be addressed as part of national policies on chemicals management, environmental protection, public health and sustainable development;
- To facilitate efforts of dealing with broader environmental issues such as pollution and hazardous wastes control and overall pollutant releases and the development and strengthening of national sustainable development strategies; and
- To facilitate country's overall efforts in coordinating national approaches to other chemical related Regional and International Agreements; specifically, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals

and Pesticides in International Trade and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Implementation of chemical related programs falls within the mandate of several government departments within different Ministries. The Department of Environmental Affairs (DEA) is charged with the coordination of all Multilateral Environmental Agreements including the Stockholm Convention on POPs and therefore the DEA is responsible for the coordination of the implementation of the POPs NIP.

The implementation process of the NIP will begin in 2008/9 period. Once the final document has been approved and funds are released the formal implementation process will begin. However certain activities such as legislative review can start at any time. The action plan part summarizes the activities up to 2013, since most implementation activities are anticipated to end within 6 years of the commencement date. Certain activities e.g. PCB phase-out will continue to the deadline laid out in the Convention. This will, however be reconciled with the Southern African Development Community (SADC) PCB program, to which the Botswana is also affiliated and this will complement the NIP implementation process.

#### **3.2.1.4 General outcomes of the NIP Implementation**

- The expected outcomes of the NIP Implementation are outlined below:
- Awareness on the effects of POPs on human health and the environment;
- Effective control of PCBs and unintentionally produced POPs;
- Enhanced institutional, organizational and legal capacity to the level required for effective management of POPs;
- Appropriate technology and technical facilities available for control, storage, treatment and disposal of POPs
- Stakeholder involvement in the management of POPs in the country.

#### **3.2.1.5 Implementation Principles**

The following principles were considered during the development of the NIP and will be adhered to during the implementation process:

- Public and stakeholder participation
- Transparency in information sharing and exchange particularly related to monitoring and reporting on implementation activities
- Adherence to the polluter – pays and precautionary principles
- Integration within the overall environmental management and sustainable development policies, particularly the EMPS 2000-2010
- Adherence and use of technologies and applications of international standards
- Commitment to public awareness and education

#### **3.2.1.6 Priorities and Conditionality**

Priorities were identified during the priority setting workshop in January 2008 and are listed below (Table 37). Response measures to national priorities are reflected in the action plans developed under different chapters of the NIP.

**Table 37: POPs related priorities of Botswana**

Priority areas	Rank
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Priority areas	Rank
Occupational safety measures for POPs management and use	1
Education and awareness on POPs	1
Appropriate legal and administrative framework	1
Enhancing commitment for POPs management at the policy maker level	2
Environmentally sound management of POPs, specifically PCB containing equipment and wastes	3
Capacity building for enforcement and monitoring agencies including technical infrastructure for POPs management	4
To achieve continuous release reduction of Annex C POPs	5
Controlled use of DDT for malaria vector control	5
Rehabilitation and management of contaminated sites	5
Research and development to establish the level of environment and human health impacts of POPs	6

Since the National Implementation Plan is indeed a plan, there are certain conditions, which should be fulfilled during the implementation process. Throughout the NIP development process, we considered that the following conditions are present and assured. This plan can only be implemented if these needs are fulfilled and qualifications are available.

- Government commitment in providing the necessary financial and human resources as well as the requested in-kind contributions,
- Commitment among the stakeholders, who participate in the implementation process,
- The availability of international assistance
- No unexpected events occur
- The necessary qualification of the personnel involved in NIP implementation is fulfilled

In this context commitment not only means ideological and financial commitments, but it also means that the necessary time is provided; time for those, who will participate in the project as consultants or committee members. It is equally important that the responsible authorities act in time. This means for example that certain documents or actions be reviewed in the allocated time, or to take decisions in a certain timeframe.

### 3.2.1.7 Institutional/Organisational Arrangements and Responsibility

The POPs Committee, which is still to be formerly established, will oversee the NIP implementation process through the review and approval of:

- Technical reports
- Financial report

The committee will meet on a quarterly basis to review and monitor progress, and attend to other issues as per the committee terms of references.

The expenditure associated with coordination of the implementation of the NIP is shown in the table below (Table 38).

**Table 38: Budget for NIP coordination**

Activity	Responsibility	Annual Expenditure (US\$)
Review and Monitoring progress	POPs committee	36 000
National Coordination	NIP coordinator	60 000
Transportation	NIP coordinator	18 000
TOTAL		114 000

Performance monitoring indicators will be used to assess the effectiveness of implementation activities. These would be done firstly through evaluation of reports from implementing bodies, for example evaluation of the extent to which that body has been able to deliver/complete particular elements of the activity. Secondly, it is envisaged that the executive agency performs independent reviews of the different activities to ascertain whether the objectives have been achieved. Such reviews shall take into account the principles defined in the implementation strategy. The performance monitoring indicators will be developed for each action plan, before its implementation begins.

The NIP implementation will start in 2008 and encompasses 6 years; up to 2013. The total NIP implementation is estimated to be 10.1 million US\$, which does not include the cost of disposal of PCBs. Resource requirements are elaborated in Table 51.

### **3.3 STRATEGIES AND ACTION PLANS PART OF THE NIP**

#### **3.3.1 Activity: institutional and regulatory strengthening measures**

##### **3.3.1.1 Objectives and priorities of the action plan**

As a party to the Stockholm Convention on Persistent Organic Pollutants (the Convention), Botswana is under an obligation to take positive measures to implement it. It is a requirement under the Convention that each Party should put in place control measures to eliminate production and use of POPs. In order to achieve this, Botswana should ensure that the institutional and regulatory measures are strengthened, thereby creating an enabling legislative environment for the implementation of the Convention. Currently, the country has no explicit and comprehensive legislation on Persistent Organic Pollutants (POPs). Additionally, the Constitution itself does not make provision for environmental rights. This therefore makes regulation and monitoring of POPs a challenge. This challenge can be addressed by reviewing the legislation in place to incorporate the provisions of the Convention and to augment the regulatory measures in place to ensure adherence to the requirements under the Convention.

##### **3.3.1.2 Summary of the inventory findings**

Generally, there are several pieces of legislation that deal with management and control of pollutants and chemicals but these do not address POPs specifically. There is no overarching legislation covering POPs or the environment as a whole. As a result POPs related issues are usually addressed by the interpretation of the inadequate existing laws. POPs are also insufficiently or not covered at all by the import and export regulations. This has led to a situation where there is very little control and monitoring over the movement and use of POPs in the country. There is therefore a need to consolidate the existing laws and regulations addressing the POPs component and amend them where necessary to bring them in line with requirements of the Convention.

There is also a need to improve institutional capacity. POPs is a technical subject and a general understanding on POPs related issues is currently limited to a few specialist institutions within Government e.g. DWMPC. As such, there is a need for institutions concerned with policy, planning and legislation, the civil society and the users to strengthen their understanding of the POPs issues.

##### **3.3.1.3 Action plan implementation**

The following discussion elaborates on the activities to be carried out in order to facilitate the strengthening of the regulatory and institutional measures.

## Institutional Measures

- Training personnel to develop capacity to implement the provisions of the Convention. This includes personnel from institutions that will be instrumental in facilitating the implementation of the Convention. The key stakeholders include the Department of Waste Management and Pollution Control (DWMPC), Ministry of Agriculture (MoA), Ministry of Health (MoH) and Botswana Unified Revenue Services (BURS). This will contribute towards the enhancement of knowledge on POPs planners and implementers.
- Establishing an Inspectorate within the DWMPC to monitor the import and usage of POPs. (Functions of the Inspectorate)
- Build capacity at BURS to effectively control POPs import and export.
- Strengthen existing capacity for POPs analysis. (Lab analysis)
- Designate relevant competent authorities for the implementation of the Convention.
- Provide training for stakeholder institutions so that they can provide information on POPs to the users (linked with information centre in action plan).

## Regulatory Measures

- Revise environmental legal framework to incorporate legislative provisions on POPs. To achieve this, it is important to identify gaps in the current legislation with regards to national, regional and international standards and needs, relating to POPs in order to cover the various aspects of POPs related issues.
- Undertake wider stakeholder consultation on harmonization of sectoral environmental laws (e.g. Waste Management Act, Public Health Act, Chemical Products and Substances Act., Environmental Management Bill, Agrochemicals Act, etc).
- Include POPs related priorities into the NDP10/DDP7/UDP3.

The abovementioned activities are summarised in the table below (Table 39).

**Table 39 Action plan for institutional and regulatory changes**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To strengthen institutions to effectively implement the provisions of the Convention by 2010	Training personnel to develop capacity to implement the provisions of the Convention.	24 months	DEA	DWMPC DEA MoH BURS (Customs)	\$88 000
	Establishing an Inspectorate within the DWMPC to monitor the import and usage of POPs.	12 months	DWMPC	DWMPC BURS	\$100 000
	Build capacity at BURS to effectively control POPs import and export	12 months	DEA	DEA MoH BURS (Customs) DWMPC	\$5000
	Strengthen existing capacity for POPs analysis	12 months	DWMPC	Stakeholder laboratories DWMPC MoA MoH BURS	\$142 000
	Designate relevant competent authorities for the implementation of the Convention.	Continuous	DEA	DEA MoH DWMPC MoA	\$5 000
	Strengthen stakeholder institutions so that they can				

	provide information on POPs to the users (linked with information centre in action plan 3.3.13)	Continuous	DEA DWMPC	DWMPC MoH MoA	\$5 000
					<b>\$345 000</b>
2. To strengthen regulatory measures by 2010	Revise environmental framework legislations to incorporate regulation on POPs.	24 months	DEA	DWMPC DEA MoH	\$72 000
	Undertake wider stakeholder consultation on harmonization of sectoral environmental laws (e.g. Waste Management Act, Public Health Act, Chemical Products and Substances Act., Environmental Management Bill, Agrochemicals Act, etc)	12 months	DEA	BURS Industry Civil Society MoA	
	Include POPs related priorities into the NDP10/DDP7/UDP3.	12 months	DEA	DWNP DMS DWMPC DOT	\$5 000
					<b>\$77 000</b>
Coordinator: DEA Period: 2 years Cost: \$422 000					

### 3.3.1.4 Timeframe, budget and coordination

The overall coordination of the implementation of this action plan will be undertaken by the Department of Environmental Affairs under the Ministry of Environment Wildlife and Tourism. The implementation timeframe is 2008 – 2010. The estimated budget is \$ 442 000.

### 3.3.2 Activity: measures to reduce or eliminate POPs releases from intentional production and use

Regulatory measures addressing Article 3 of the Stockholm Convention are elaborated in action plans 3.3.3, 3.3.4, 3.3.5.

### 3.3.3 Activity: production, import and export, use, stockpiles and wastes of Annex A POPs pesticides (Annex A, part I. chemicals)

#### 3.3.3.1 Objectives and priorities of the action plan

The objective of the Action plan is to put in place measures that would control and regulate the importation, distribution, use and disposal of chemicals listed in Annex A and other pesticides.

#### 3.3.3.2 Summary of the inventory findings

The process of inventorising POPs pesticides was carried out in two phases. The first phase was to compile an inventory on POPs pesticides in the farming community. In order to achieve this three agricultural regions (Central, North West and Southern Region) were selected on the basis of agricultural activities and this resulted in the task team visiting 78 farms and 3 control areas. During this process no POPs pesticides were identified. The second phase of inventorising the

POPs pesticides was carried out in the four main cities of Botswana which are Gaborone, Francistown, Lobatse and Selibe Phikwe. During this phase training institutions, chemical industries, and construction sites were visited and 78 litres of Chlordane was identified. The Chlordane identified was labelled for use in the control of termites in building constructions.

Apart from Plant Protection Division stockpiling empty containers and obsolete pesticides from farmers in the warehouse at Sebele, most end users of pesticides do not have measures for safe storage and disposal of such waste.

In the view of the fact that pesticide labelling is a legal requirement which must provide all necessary information about the contents, therefore such a label was the only means of identifying pesticides. In the absence of this label, there was no means of identifying whether the product was a POPs pesticide.

The use of proper protective equipment in the application of pesticides is a critical issue as most of the pesticide applicators did not have it. This in most cases was due to management not providing such equipment.

### **3.3.3.3 Action plan implementation**

To review the existing legislation by 2011: This objective will address the loopholes already identified in the Agrochemicals Act of 1999, which only provides for registration and licensing of agrochemicals to control their importation, manufacture, distribution, use and disposal but leaves out industrial and public health pesticides.

To have monitoring tools for production, use, importation and exportations all chemicals listed in Annex A and other pesticides by 2010: This objective will work effectively once the legislation has been reviewed to include other pesticides which are not meant for agricultural purposes. By registering all the pesticides the necessary documents will be a requirement at points of entry for importation and exportation.

To develop training programmes for enforcement and monitoring agencies by 2010: The training programmes developed will be mainly for personnel such as inspectors and custom officials. This will assist them in effectively identifying pesticides and later on regulating the transboundary movement and usage in the country.

To have an updated inventory of POPs pesticides (current stocks, obsolete stock and empty containers) in the country by 2010: This objective will assist the concerned department to have knowledge on the present pesticides, obsolete pesticides and empty containers in Botswana.

To ensure proper management of POPs pesticides, obsolete pesticides and empty containers in the country by 2013. This objective addresses putting in place measures that would ensure safe handling of pesticides in terms of use, storage and finally disposing off in countries that have proper disposal facilities.

Create public awareness and monitor the usage of chemicals by 2013: The public at large being the end users of the pesticides need to be informed on many issues regarding the use of pesticides, their effects on the environment, human, plant and animal life. Usage will be monitored by ensuring that licenses are only issued to competent dealers as well as conducting inspections.

To promote the use of appropriate protective equipment when handling chemicals listed in Annex A and other pesticides by 2013. This objective will address the importance of using protective equipment when handling pesticides through demonstrations and training workshops.

The action plan is shown in Table 40.

**Table 40: Action plan on measures addressing Annex A, Part I POPs chemicals (Pesticides)**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To review the existing legislation by 2011	Stakeholder Consultation	10 months	DEA, DCP, DPH, DoSH, Occupational health and safety	AG, MOH, Industry, BOBS, DAH & P,	\$25 000 (Government funding)
	Review legislation	24 months			
To have monitoring tools for production, use, importation and exportations all chemicals listed in Annex A and other pesticides by 2010	Register all chemicals intended for production, use, importation and exportation in Botswana.	Continuous	DEA, DCP, DPH, DOSH, BURS, DWMPC	BOBS,	\$50 000 per year Government funding
	Provide Port health services	Continuous			
To develop training programmes for enforcement and monitoring agencies by 2010	Develop educational training materials on POPs agrochemicals	6 months	DEA, DCP, DOSH, DWMPC, BOBS.	BURS, Educational Institutions, Chemical Industries	\$25 000 30 % international funding, 70% government funding
	Conduct training workshops	3 months			
To have an updated inventory of POP's pesticides (Current stock, Obsolete stock and empty containers) in the country by 2010	Provide training for field assistants on data collection	3 months	DEA, DCP, MOH, DOSH	Industries, Farming community, MOE, Local Authorities	\$432 000 33% international funding 66% government
	Inventorise all annex A pesticides, obsolete pesticides and empty containers	continuous			
	Enter data into database	continuous			
To ensure proper management of POPs pesticides, obsolete pesticides and empty containers in the country by 2013.	Put in place measures to ensure appropriate management of POPs pesticides	Continuous	DCP, DWMPC, MOH, MOE, DEA	DAH & P, Farming Community, Industries,	\$200 000 70 % Government funding 30% international
	Collect and store POPs pesticides waste, including obsolete pesticides and empty containers. Export all the collected waste for final disposal.	60 months			

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
Create public awareness and monitor the usage of chemicals by 2013	License all chemical dealers	Continuous	DCP, DEA, MOH, DAH & P, DWMPC,	Community at large, Farming community, Chemical industries, Educational Institutions, NGO,s	\$225 000 per annum
	Develop educational material on the use of chemicals	24 months			Government
	Carry out inland inspections	Continuous			
To promote the use of proper protective equipment when handling chemicals listed in Annex A and other pesticides by 2013.	Conduct training workshops and demonstrations on responsible use of chemicals	Continuous	DCP, DOSH, DWMPC, MOH, DAH & P, NGO's	Community at large, Farming community, Chemical Industries, Educational Institutions	\$ 10 000 Government funding

#### 3.3.3.4 Timeframe, budget and coordination

The overall coordination of the implementation of this action plan will be undertaken by the Plant Protection Division under the Ministry of Agriculture. The implementation timeframe is 2008 – 2013. The estimated budget is \$ 2 067 000.

#### 3.3.4 Activity: production, import and export, use, identification, labelling, removal, storage and disposal of PCBs and equipment containing PCBs (Annex A, part II chemicals)

##### 3.3.4.1 Objectives and priorities of the action plan

The action plan for the management of Polychlorinated Biphenyls (PCBs) was prepared in accordance with the requirements of the Stockholm Convention on Persistent Organic Pollutants. The objective of the action plan is to determine the extent of pollution by Annex A Part II POPs chemicals and quantities of these in various locations in Botswana. Its overall objective is to phase out importation and use of PCBs. The NIP will also inform Botswana's strategies for handling and disposal of PCBs.

##### 3.3.4.2 Summary of the inventory findings

The development of this action plan was preceded by an inventory exercise intended to establish the extent of PCB contamination in Botswana. A total of 619 oil-containing equipments (predominantly transformers) were tested for PCBs using the Clor -N- Oil 50 test kit. The tested equipment constitutes about 10% of the national existing equipment. Test results indicated that about 54% of all the tested equipment was PCB contaminated. The inventory further revealed that 46% of the equipment tested was either PCB free or the PCB content was below 50 ppm. Some of the highlights from the inventory exercise recommendations included but not limited to the following:

- Intensify public awareness and education of various stakeholders
- Consider development of the legal frame work which prohibits the importation of PCB containing equipment as well as progressive phasing out of PCBs.

- To complete the inventory exercise and further on conduct a quantitative analysis of the tested equipment.

In an endeavour to address PCBs in coordinated manner, a task force comprising a multi-sectoral committee was formed. The PCBs action plan was developed with the view to fast track the POPs convention phase-out programme and ensure the proper management of the PCBs.

The PCBs action plan below illustrates milestones to be covered, budgetary provisions and remedial responsibilities in order to ensure conformity to the POPs convention.

### 3.3.4.3 Action plan implementation

The first objective in this action plan is to complete the national inventory for Annex A part II POPs chemicals by end of 2010. The PCB inventory will start by reassembling of regional teams and procurement of test kits at a cost of \$400,000. Overall inventory should be completed within five months starting April 2008. The coordinating agency is the Department of Waste Management and Pollution Control (DWMPC).

The Waste Management Act should be revised to address article 3 of the Stockholm Convention , specifically PCBs by 2011. The purpose of the exercise will be to enable the Waste Management Act to address article 3 of the Stockholm Convention, with regard to PCBs. The exercise is estimated to run for 24 months at a cost of \$50 000 with the lead institution being DWMPC.

Occupational health and safety measures for Annex A part II POPs chemicals will be implemented by 2011. The exercise aims at developing appropriate guidelines and programmes to enable adherence to occupational, health and safety standards amongst users. It is estimated that the exercise will take 15 months at a cost of \$200 000 with the DWMPC as the lead institution.

To develop mechanisms for rehabilitation and management plan for contaminated sites and contaminated equipment will entail determination of the extent of contamination, development of appropriate management plan for containment and rehabilitation. It is estimated that the exercise will take 9 months at a cost of \$120,000 with the DWMPC as the lead institution.

The development of environmentally acceptable strategies for the management of PCB containing equipment by 2010 will entail conducting a gap analysis, benchmarking, capacity building and implementation and monitoring. It is estimated that the exercise will take 11 months at a cost of \$80 000 with the DWMPC as the lead institution.

The establishment of the appropriate infrastructure for PCB management by 2015 will require land acquisition, budgetary provision, construction of the storage facility, and procurement of equipment. It is estimated that the exercise will take 54 months at a cost of \$1 105 000 with the DWMPC as the lead institution.

The action plan is elaborated in Table 41.

**Table 41: Action plan on measures addressing Annex A part II chemicals (PCBs)**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To complete National PCB inventory by 2010	<ul style="list-style-type: none"> <li>Reassemble regional teams</li> <li>Procurement of test kits</li> <li>Consult stakeholders for resource availability.</li> <li>Conduct quantitative analysis</li> <li>Compilation of inventory</li> </ul>	2 weeks 2 months 1 week Continuous 3 months  <b>5 months</b>	DWMPC	BPC Tati Nickel Mupani BCL BOTASH Debswana Morupule Colliery DEBS WUC Botswana Railways	\$200 000  \$100 000 \$100 000
To review the Waste Management Act to address Article 3 of the SC, specifically PCBs by 2011	<ul style="list-style-type: none"> <li>Stakeholder consultation</li> <li>draft policy</li> <li>submit draft to AGs for review then pass it to parliament</li> <li>consolidate and make write up</li> </ul>	      <b>24 months</b>	DWMPC DEA AG chambers Local Government		\$30 000 \$6 000 \$10 000  \$4 000
To develop environmentally acceptable strategies for the management of PCB containing equipment by 2010	<ul style="list-style-type: none"> <li>Gap analysis/identification</li> <li>Benchmarking</li> <li>Capacity building</li> <li>Development of strategies</li> <li>Implementation and monitoring</li> </ul>	3 months 2 months 3 months 3 months Continuous  <b>11 months</b>	DWMPC	Mining industries Manufacturing industries BPC	\$20 000 \$35 000 \$15 000 \$5 000 \$5 000
To develop a (mechanism for rehabilitation of contaminated sites and equipment) rehabilitation and management plan for contaminated sites and contaminated equipment by 2010	<ul style="list-style-type: none"> <li>Determine extent of contamination</li> <li>Development of appropriate management plan for containment</li> <li>Rehabilitation exercise</li> </ul>	3 months 6 months Continuous  <b>9 months</b>	DWMPC	Local Authorities Mining industries Manufacturing industries BPC	\$100 000 \$20 000  TBA
To have proper measures in place at workplaces, where Annex A POPs occupational and safety are released by 2011	<ul style="list-style-type: none"> <li>Provide appropriate PPE.</li> <li>Provide safety measures on POPs</li> <li>Monitor usage of PPE.</li> </ul>	9 months 6 months Continuous  <b>15 months</b>	DWMPC	Local authorities BPC Mining Industries Manufacturing industries DBES MoH Forestry	\$ 100 000 \$ 100 000  Governme nt
To provide appropriate infrastructure for PCB management by 2015	<ul style="list-style-type: none"> <li>Acquire land</li> <li>Secure funds</li> <li>Construction of storage facility</li> <li>Procurement of equipment</li> </ul>	12 months 6 months 24 months 12 months  <b>54 months</b>	DWMPC MoLH MoF DEBS	Local Authorities Mining industries Manufacturing industries BPC	\$5 000  \$ 800 000 \$ 300 000
Coordinator – Ministry of Environment, Wildlife and Tourism – DWMPC Start April 2008 Period - 6 years (year of start) Total Cost - \$ 1 955 000					

#### **3.3.4.4 Timeframe, budget and coordination**

The overall coordination of the implementation of this action plan will be undertaken by the Department of Waste Management and Pollution Control under the Ministry of Environment, Wildlife and Tourism. The implementation timeframe is 2008 – 2014. The estimated budget is \$ 1 955 000, which does not include the cost of disposal of PCB containing and contaminated equipment and wastes.

#### **3.3.5 Activity: production, import and export, use, stockpiles and wastes of DDT (Annex B chemicals) if used in the country**

##### **3.3.5.1 Objectives and priorities of the action plan**

Malaria is one of the most serious tropical diseases in the Sub Saharan region, affecting more than 300 million and causing approximately 1 million fatalities per year. Malaria is endemic in over 100 countries of the world and in the SADC region 88 million people live in malaria transmission areas. More than 21 million people fall sick from malaria each year and about 250-300,000 die of malaria each year. In areas of stable malaria transmission more children under the age of five die from the disease than adults. However in areas of unstable transmission more adults than children die from the disease. In some areas of unstable transmission the disease could affect the population the same way, with all age groups affected equally. Malaria transmission in Botswana is unstable and the disease incidence is similar across all age groups.

For many years Botswana has engaged efforts to control the disease and the control measures have taken the form of vector control through the use of Indoor Residual Spraying (IRS), case management, and public awareness. From as far back as the early 1950s, the country used different insecticides to control malaria vectors. DDT was the insecticide of choice until 1997 when it was replaced by pyrethroids. While DDT remains a highly controversial insecticide, its value as a useful public health product remains insurmountable. Justification for the use of DDT can be found in the acknowledgement of malaria as a serious health hazard. Other factors which justify for the reintroduction of DDT are:- High malaria vector susceptibility levels to DDT, reported reduction in pyrethroid susceptibility levels and among others is the resurgence of malaria in areas where the disease was previously controlled, eliminated or unknown to exist. The use of DDT for IRS remains a cost-effective intervention for most parts of Africa, hence it is expected that its use will continue for the foreseeable future.

##### **3.3.5.2 Summary of the inventory findings**

In view of all the above it is therefore the priority of the country to start all the processes which will allow for the reintroduction of DDT for use in IRS. In accordance with the provisions of the Stockholm Convention, the country therefore must notify the secretariat on the intended use of DDT. While DDT is a well known insecticide, having come into use as far back as the first world war, many myths continue to prevail regarding the value of the insecticide in public health. It is important therefore to state that the adverse effects of DDT which are usually talked about did not result from its use in public health but rather from its use in agriculture. It is also important that the program of action for the reintroduction of DDT should have a strong public awareness component. Consultation of the communities in malaria areas where DDT would be sprayed should be considered as a matter of priority. In view of the diminishing arsenal of available cost-effective insecticides for malaria vector control and challenges of vector resistance, it is imperative that DDT be seen as a resource for both current and future generations. However

appropriate policies, effective regulations and enforcement, and good reporting will be important for all public health insecticides, particularly DDT.

### 3.3.5.3 Action plan implementation

Reintroduction of DDT will certainly require that information is given to communities where the insecticide is going to be applied. The media will have to be engaged to relay information on DDT to the public and it will be critical to ensure that the media is well informed on the subject of DDT. However, without effective and appropriate involvement of every member of the community then the full potential of DDT will not be realized. The action plan necessitates collaboration between the different and relevant stakeholders will become more critical in the advent of DDT use. Operational issues with regard to public acceptance of IRS will become more relevant with DDT use. The action plan is developed in Table 42.

**Table 42: Action plan on measures addressing Annex B chemicals (DDT)**

Objective	Activity	Timeframe	Implementing institutions	Stake holders	COST
To review the current legislation and administrative framework by end of 2009	<ul style="list-style-type: none"> <li>Stakeholder consultation</li> <li>Review relevant legislation</li> <li>Regulate the importation of DDT</li> </ul>	24 months	MoH AGs	MLG DEA MOA	\$40 000
To use DDT according to Article 3 and Annex B to the SC by Sept 2008.	<ul style="list-style-type: none"> <li>Stakeholder consultations</li> <li>Prepare reports</li> <li>Inform WHO and the Secretariat to continue the use of DDT</li> <li>Procure required quantities of DDT</li> <li>continue looking for safer/effective alternatives</li> </ul>	5 months  Continuous  Continuous	MoH DEA	Communities in malaria areas MLG WHO UNEP	\$10 000 MoH- 50% DEA-50%  \$400 000 for 4 years
To ensure the usage of DDT only for Malaria vector from Sept 2008	<ul style="list-style-type: none"> <li>Establish the extent of DDT use in other sectors</li> <li>Monitor usage</li> </ul>	6 months  Continuous	MoH	MLG BURS MOA DEA	\$2 000  \$12 000
To have in place safe application and handling mechanisms by Sept 2008	<ul style="list-style-type: none"> <li>Train workers in the use and handling of insecticides</li> <li>Raise awareness in the affected households</li> <li>Revise guidelines for handling and use</li> <li>Provide protective equipment (PPE)</li> <li>Safe disposal</li> </ul>	Continuous  Continuous  3 Months  Continuous  Continuous	MoH MLG	DEA dwmpc	\$80 000
To monitor the impact of DDT on malaria incidence by end of May 2010	<ul style="list-style-type: none"> <li>Weekly notifications from the districts</li> <li>Compilation of report</li> </ul>	Continuous  Continuous	MOH	MLG	Gov Funded
To have appropriate management of empty containers	<ul style="list-style-type: none"> <li>Development of a procedure to address the management of</li> </ul>	12 months	MoH DWMPC	DEA MLG	\$20 000

Objective	Activity	Timeframe	Implementing institutions	Stake holders	COST
and obsolete insecticides by Sept 2008	empty containers and dealing with obsolete insecticides <ul style="list-style-type: none"> <li>• Incorporation of the procedures into the spraying training programs</li> </ul>	Continuous			\$5 000
To have in place effective insecticide resistance monitoring by Nov 2008	<ul style="list-style-type: none"> <li>• Acquisition of insecticide susceptibility and bioassay test kits</li> <li>• Conducting the tests</li> <li>• Assess the malaria vector dynamics</li> <li>• Preparing report for submission to Secretariat and WHO every 3 years</li> </ul>	5 Months Continuous Continuous Continuous	MOH	MLG  UNEP	\$2 000  \$49 000  Govt Funded
Coordinating Institution – Min of Health – Epidemiology/Entomology Unit Period (Adopt the longest period) -5yrs Total cost- 620 000 USD					

Botswana has already a well coordinated IRS program; as such the reintroduction of DDT should not face lots of logistical difficulties. A review of the current legislation governing the use of pesticide should be considered with the view of ensuring that regulations on DDT are included. While the insecticide is expected to be reintroduced into the country as early as 2008 spraying season, the review could take as long as 24 months. The formalities of notifying the secretariat and informing WHO can be done within a few months as it is just a matter of writing using the standard prescribed by the secretariat. Because it is known that DDT can be used for some other purposes outside malaria vector control it will be important that measures are put in place to ensure that it used strictly for malaria control. The sector that could attract a lot of attention in as far as the use of DDT is concerned is the Ministry of Agriculture therefore, due consultation and collaboration is important. Due to controversy surroundings of DDT it is critical that measures of proper disposal are put in place. This includes the appropriate protective equipment and ensuring that empty containers and obsolete insecticides are handled, and disposed of in an environmentally sound manner. As part of the requirements of the Stockholm convention, parties using DDT should report to the secretariat every three years on the progress with regard to the use of the same. The report should include the impact of the insecticide on the disease and how it has affected the vector dynamics. The area of reporting is expected to be undertaken by the Entomology Unit in the Ministry of Health, which has the capacity to monitor the vectors of malaria.

#### 3.3.5.4 Timeframe, budget and coordination

The timeframe for the above action plan is 05/2008 to the end of 2012 and a total budget of \$620 000 is proposed. Some of the activities will be covered under the recurrent government budget. The Ministry of Health will be the coordinator through its Epidemiology/Entomology unit

#### 3.3.6 Activity: register for specific exemptions and the continuing need for exemptions (article 4)

The Government of Botswana is not willing to file for an exemption under the Stockholm Convention. This action plan will be elaborated if the need arises to file for an exemption.

#### 3.3.7 Action plan: measures to reduce releases from unintentional production (article 5)

### **3.3.7.1 Objectives and priorities of the action plan**

The Stockholm Convention on Persistent Organic Pollutants (POPs) requires parties to reduce the total releases of unintentionally produced POPs such as polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzo furans (PCDF) with a goal of their continuing minimization and where feasible, ultimate elimination. Accordingly, the action plan is to assist Botswana to identify sources of dioxins and furans and quantify their releases.

### **3.3.7.2 Summary of the inventory findings**

The inventory statistics show that dioxins and furans are released to air more than to other media. Releases to air amount to 256.837 g TEQ per annum, followed by releases to land about 21.3 g TEQ per annum and with releases to water being 0.047 g TEQ per annum which is quite insignificant. The results also demonstrate that waste incineration and uncontrolled combustion processes are potentially the most significant sources of dioxins and furans in Botswana. These two source categories contribute approximately 90% of the total dioxin and furan estimates. Emissions to air are contributed most by waste incineration. This source category being the principal emitter releasing an amount of 203.156 g TEQ per annum followed by uncontrolled combustion processes.

The overall dioxin and furan emissions for the baseline 2006 amounted to 291.883 g TEQ per annum. The inventory results are subjected to some degree of uncertainties since the study was based on default emission factors.

### **3.3.7.3 Action plan implementation**

The action plan on Annex C releases were developed through multi-stakeholder participation. The plan recognizes that preliminary inventories considered only PCDD/Fs releases, due to unavailability of toolkits for the rest of the chemicals listed in Annex C. The action plan addresses the development of the inventories of PCBs, HCB, to have all annex C POPs inventories developed.

Main elements of the plan include:

To complete the national inventory for Annex C POPs chemicals by end of 2009. Completion of the PCCD/F inventory will start by training of key stakeholders on the completion of the inventory questionnaire and training should be completed in the first three months of the exercise. Overall inventory should be completed within six months starting April 2008. The coordinating agency is the Department of Waste Management and Pollution Control (DWMPC) in conjunction with the Department of Environmental Affairs (DEA). This is estimated to cost \$ 30 000.

To strengthen competent authorities for proper enforcement of the legislations on Annex C POPs chemicals by the end of 2011. This will be accomplished through adequately equipping the laboratory and adequate training of inspectors and laboratory personnel. The exercise is estimated to take 24 months at a cost of \$160 000, with the lead institution being the DWMPC.

To review and enact enabling legislation by 2011 will need to be undertaken. The purpose of the exercise will be to take key stakeholders on board in adopting the principle of Best Available Technology/ Best Environmental Practices (BAT/BEP), with the purpose of reducing emissions of Annex C POPs chemicals from point sources. The exercise is estimated to run for 24 months at a cost of \$71 000, with the lead institution being DWMPC.

To establish occupational health and safety measures for Annex C POPs chemicals by 2010. The exercise aims at developing appropriate guidelines and programmes to enable adherence to

occupational, health and safety standards amongst users. It is estimated that the exercise will take 15 months at a cost of \$200 000, with the DWMPC as the lead institution.

To develop emission factors for Botswana by 2012. This exercise will cost \$262 000 within a time span of 20 months. It aims at developing local capacity to determine local emission factors for use in our inventory. The lead institutions are DWMPC, University of Botswana (UB) and Botswana Bureau of standards (BOBS).

To raise awareness amongst stakeholders for proper management of Annex C POPs chemicals by 2009. This will ensure adoption of BAT and BEP for the reduction of release of these chemicals from their sources. The activity is estimated to run for 9 months at a cost of \$110 000. The lead institutions are DWMPC, DEA, MoH, Metrological services and MoA.

The action plan is elaborated in the table below (Table 43).

**Table 43: Action plan on measures to reduce releases from unintentional production**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To complete the national Annex C POPs inventory by end of 2009	• Consult stakeholders for resource availability.	1 month	DWMPC	Local authorities	\$5 000
	• Capacity building (training workshops for stakeholders)	2 months		BPC	\$15 000
	• Compilation of inventory	3 months		Mining Industries Manufacturing industries	\$10 000
To strengthen competent authorities for proper enforcement of the Annex C POPs related legislations by the end of 2011.	• Laboratory capacity	12 months	DWMPC	Local authorities	\$60 000
	• Training for the inspectors and laboratory personnel	12 months		BPC Mining Industries Manufacturing industries	\$100 000
To review and enact enabling legislation by 2011.	• Stakeholder consultation	3 months	DWMPC	Local authorities	\$30 000
	• Review existing incinerator guidelines	3 months	DEA	BPC	\$6 000
	Enact Best Available Technology/Best Environmental Practices(BAT/BEP)	18 months		Mining Industries Manufacturing industries	\$35 000
Public education and awareness by the end of 2009.	• Stakeholder consultative forums (workshops, etc.)	3 months	DWMPC	Local authorities	\$30 000
	• Development and dissemination of educational material	6 months	DEA MoH Meteorology MoA	BPC Mining Industries Manufacturing industries	\$80 000
To establish occupational, health and safety measures for Annex C POPs by the end of 2010.	• Provide guidelines for appropriate PPE.	continuous	DWMPC	Local authorities	\$100 000
	• Develop and implement appropriate safety programme on Annex C POPs.	6 months		BPC	\$100 000
	• Monitor usage of PPE.	Continuous		Mining Industries Manufacturing industries	
To develop local /country	• Capacity building	3 months	DWMPC	Local Authorities	\$15 000
	• Procurement of	6 months	University of	Division of	\$200 000

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
emission factors by the end of 2012	equipment <ul style="list-style-type: none"> <li>• Sampling and testing</li> <li>• Analysis of results</li> <li>• Development of emission factors.</li> </ul>	3 months 2 months 6 months	Botswana (laboratory backup) BOBS	occupational health and safety Industries	\$30 000 \$5 000 \$12 000

#### 3.3.7.4 Timeframe, budget and coordination

The action plan implementation process will be coordinated by the Department of Waste Management and Pollution Control under the Ministry of Environment, Wildlife and Tourism. The implementation will start in April 2008 and will last for 5 years. The total cost is estimated to be \$ 833 000.

#### 3.3.8 Activity: measures to reduce releases from stockpiles and wastes (article 6)

Regulatory measures addressing Article 6 of the Stockholm Convention are elaborated under chapters 3.3.1, 3.3.3, 3.3.4, 3.3.5.

#### 3.3.9 Strategy: identification of stockpiles, articles in use and wastes

Activities related to the inventories of POPs stockpiles, articles in use and wastes are elaborated under chapters 3.3.1, 3.3.3, 3.3.4, and 3.3.5.

#### 3.3.10 Activity: manage stockpiles and appropriate measures for handling and disposal of articles in use.

Activities related to the management of POPs stockpiles, and appropriate measures for handling and disposal of articles in use are elaborated under chapters 3.3.1, 3.3.3, 3.3.4, 3.3.5.

#### 3.3.11 Strategy: identification of contaminated sites (Annex A, B and C Chemicals) and remediation in an environmentally sound manner

##### 3.3.11.1 Objectives and priorities of the action plan

To identify and document sites contaminated with POPs chemicals and put in place measures to prevent releases from contaminated sites of Annex A, B and C chemicals in order to safeguard human health and environment.

##### 3.3.11.2 Summary of the inventory findings

According to Botswana legislation (Waste Management Act of 1998), it is the responsibility of the polluter to clean and rehabilitate the polluted site. Storage of pesticides and their empty containers is vital due to the dangers associated with them. Improper storage can result in accidents such as explosions, fires and contamination. There is a problem of storage for pesticides in all entities visited i.e. farms, industries and institutions. In some instances there were no dedicated storage facilities for the pesticides, and they were stored within human dwelling areas. For example, Pesticide storage rooms in most of the schools are inside the classrooms and these rooms are normally not well ventilated hence creating odours that can be smelled from the classroom. In some farms pesticides are stored in bedrooms and kitchens. Re use of empty containers is a common practice among farmers.

There is a major problem regarding the issue of disposal of empty containers and obsolete pesticides. Apart from Plant Protection Division stockpiling empty containers and obsolete

pesticides from farmers into the warehouse other institutions do not have the right means of disposing the chemicals. Some of the chemicals were stored in the open spaces such as tree trunks and labels got destroyed by the sun.

The town councils do not provide services of disposal and they have the same problem. There could be some pesticides disposed of with general waste as they do not have any means of segregating litter when it finally reaches the landfills. (However, the city council normally outsources such services to private companies offering disposal services) e.g. Most of the schools have obsolete pesticides dating back to 20 years but they still do not know how to dispose them.

The survey could not conclusively reveal that there are no contaminated sites in the country as the survey only focused on the agricultural sectors. Large quantities of obsolete pesticides stockpiles and empty containers were found in Sebele warehouse. This needs to be remedied urgently as it is the only such facility that serves the whole nation and it is filling up to capacity which underpins the importance for clearance of the current stock.

A number of leaking PCB containing and decommissioned transformers were found, these need to be disposed of in an environmentally sound manner. In cases where incineration is the preferred disposal alternative, it is necessary to know the exact quantities of Annex C POPs produced.

### 3.3.11.3 Action plan implementation

Currently the Department of Waste Management and Pollution Control is reviewing the Waste Management Act and need to include aspects to address the management of sites contaminated by Annex A, B and C Chemicals. These issues should include provision of standards which would assist in setting limit values for POPs and adapting relevant guidelines which could be used for management of these sites. Labelling of sites, identifying remediation technologies, training and upgrading of personnel managing the sites, regular monitoring of surface and ground waters should also included in the review. The action plan is elaborated in Table 44.

**Table 44: Action plan on measures to identify and manage POPs contaminated sites**

Objective	Activity	Time frame	Implementing agency	stakeholders	Cost
To review Waste Management Act to address the management of sites contaminated by Annex A, B and C Chemicals	<ul style="list-style-type: none"> <li>Provide monitoring levels(standards)(set limit values for POPs)</li> </ul>	1 year	DWMPC, DEA	BPC, MoH, BOBS, MLG, MEWA,	\$50 000
	<ul style="list-style-type: none"> <li>Facilitate adaptation of relevant guidelines for contaminated sites</li> </ul>	6 months	DWMPC, DEA	BPC, MOH, BOBS, MLG, MEWA	\$20 000
To identify sites contaminated with POPs and assess their potential for releases by 2010	<ul style="list-style-type: none"> <li>Identify sites where chemicals have been kept</li> </ul>	1 year	DWMPC, DEA	MoH, MoA, BPC, Mines, MEWA, MWC, MLG	\$100 000
	<ul style="list-style-type: none"> <li>Sampling tests</li> </ul>	1 year	DWMPC	MLG, MoL	\$100 000
	<ul style="list-style-type: none"> <li>Write an inventory of sites and wastes</li> </ul>	6 months	DWMPC, DEA	MoH, MoA, BPC, Mines, MEWA, MWC, MLG	\$10 000

Objective	Activity	Time frame	Implementing agency	stakeholders	Cost
To prevent the releases from contaminated sites of annex A, B and C chemicals in order to safeguard human health and environment by 2010	<ul style="list-style-type: none"> <li>• Secure and label sites having stockpiles and waste to prevent releases from spreading.</li> <li>• Identify remediation technologies</li> <li>• Train and upgrade skills of personnel in management of sites.</li> <li>• Monitor surface and ground water.</li> </ul>	1 year	DWMPC,DEA ,	MLG, MoL, MOH, MOA	\$10 000
		1 year	DWMPC, DEA,	MLG, MOH, MOA MoL, BPC, Mines, MEWA,MWC	\$80 000
		6months	DWMPC, DEA	BPC, MEWA,MWC, MLG, MoL	\$200 000
		2 years	DWMPC,DEA	DWA,MEWA, ,MLG, MoL	\$200 000

#### 3.3.11.4 Timeframe, budget and coordination

The Department of Waste Management and Pollution Control under the Ministry of Environment, Wildlife and Tourism, will coordinate the implementation of this action plan. It will be implemented in 24 months commencing in April 2008 with a projected budget of US \$ 770 000.

#### 3.3.12 Activity: facilitating or undertaking information exchange and stakeholder involvement

##### 3.3.12.1 Objectives and priorities of the action plan

The objective of this action plan is to establish proper information exchange for stakeholder institutions on the Stockholm Convention and to facilitate the free flow of information sharing among stakeholders.

##### 3.3.12.2 Summary of the inventory findings

The priorities for action are determined by the need for all institutions regulating Persistent Organic Pollutants to have a holistic approach for addressing problems related to their improper management. However, since because the government has a role of regulating the chemicals, the plan should also devise a mechanism to be involved with users of POPs. A clear role for the industry on the proper management of the chemicals is essential because this will reflect the “cradle to grave” and the “polluter pays” principles. For the regulators and the industry to work harmoniously, each must be seen to play a role in the proper management of these chemicals. Therefore the objectives suggested in this action plan; facilitation of proper information exchange for stakeholder institutions and enabling the free flow of information sharing amongst stakeholders are pertinent if these have to be achieved.

Activities that relate to POPs management are currently regulated amongst different government Ministries; Ministry of Agriculture regulates activities related to agricultural pesticides; Ministry of Health on the other hand regulates activities related all other industrial chemicals. Ministry of industrial affairs presides over matters of trade and since POPs are imported into the country for trade purposes they are dealing with such aspects; similarly the Botswana Unified Revenue Services (BURS) deals with its mandate of controlling goods for customs duty purposes. Though it is the function of the Department of Environmental Affairs to oversee the implementation of

the activities of the POPs, this lack of harmonised regulation makes their task difficult. However a strategy that facilitates proper information exchange amongst stakeholder institutions and facilitation of free flow of information amongst stakeholders can at least endorse knowledge to stakeholders about inherent dangers of improper management.

### 3.3.12.3 Action plan implementation

The planned activities are to be implemented for a three year period starting 2008 .The activity proposed to resuscitate the existing POPs committee and developing its terms of reference to relate to the NIP implementations is the crucial one. The existing committee oversees the activities related to POPs and is made up of the experts from different stakeholders institutions. This will be the role of the department of Environmental Affairs as the coordinator of the implementation of the convention. Another activity proposed that can strengthen proper information exchange is the establishment of network of experts that includes the Non Governmental Organisations’ (NGOs).

The plan recognises the NGO’s and other civil groups such as the media as powerful stakeholders that can complement the work of the government by being a “watch dog” for the activities that contravene the intentions of the Convention. The plan intends to develop a strategy of using these networks for information sharing. During this plan period, the activities related to the reporting as an obligation of the Convention will also be strengthened and where necessary channels for collaborative measures be established for uniformity, conformity and to ascertain a common ground for understanding of issues in the generated reports. The identified institution for this activity is the Department of Environmental Affairs who are coordinators for the convention. The coordinating department will also oversee that a reporting format required by the convention is followed by adopting the common approach for regular Conference of the Parties reports. Cross cutting issues amongst stakeholders will also be dealt with in the convention.

The existing Environmental Information System developed at the Department of Environmental Affairs will be used to communicate further information on POPs so that the public can access information and the experts have a forum where they share technical and other issues about the chemicals. Another strategy for facilitating free flow and sharing of information involves update of DEA website for information on POPs, regular meetings and workshops to stay in touch with the stakeholders. The action plan is provided in Table 45.

**Table 45: Action plan to facilitate information exchange**

Objective	Activity	Time frame	Implementing agency	stakeholders	cost
Proper information exchange mechanism within stakeholder institutions on the Stockholm Convention by 2010	• Resuscitation of the POPs Committee and development of its ToRs/mandate (in relation to NIP implementation).	6 months	DEA	DEA and other stakeholders	\$6 000
	• Establishment of a network of experts including NGOs (national and international) to act as a clearing house mechanism	Continuous		DEA DWMPC MoA, MoH & Stakeholders	\$6 000
	• Establishment of reporting channels and collaborative measures between implementing	6 months		DEA DWMPC MoA, MoH	

Objective	Activity	Time frame	Implementing agency	stakeholders	cost
	<ul style="list-style-type: none"> <li>agencies (amongst competent authorities and stakeholders)</li> <li>Come up with a reporting format as per the convention and the strategy/approach for preparation of regular and COP reports</li> <li>Identify and devise a strategy of dealing and reporting on cross-cutting issues between POPs and related conventions (synergies)</li> </ul>	<p>2 months</p> <p>12 months</p> <p><b>26 months</b></p>		<p>INDUSTRY &amp; other Stakeholders</p> <p>DEA (with input from stakeholders)</p> <p>DEA DWMPC MoA MoH</p>	<p>\$6 000</p> <p>\$6 000</p> <p><b>\$24 000</b></p>
To facilitate free flow of information and sharing among stakeholders by 2011	<ul style="list-style-type: none"> <li>Create nodes to the Environment Information System (EIS) within all NIP implementing agencies</li> <li>Regularly update the website on POPs issues by the NIP implementing agencies.</li> <li>Regular meetings and/or workshops among the NIP implementing agencies.</li> <li>Hold regular workshops, dialogues, develop educational materials for the public, disseminate information, through media, hold debates etc.</li> </ul>	<p>6 months</p> <p>Continuous</p> <p>Continuous</p> <p>Continuous</p> <p><b>6 months</b></p>	DEA	<p>DEA AND OTHER STAKEHOLDERS</p> <p>DWMPC, DEA MoH, BPC, DMS, NGOs Other stakeholders</p> <p>DWMPC, DEA, DMS, BPC, MoH, MoA etc</p> <p>DEA, and competent authorities</p>	<p>\$100 000</p> <p>\$5 000 per annum</p> <p>\$60 000/annum</p> <p>\$60 000/annum</p> <p><b>\$225 000</b></p>

#### 3.3.12.4 Timeframe, budget and coordination

The Department of Environmental Affairs under the Ministry of Environment, Wildlife and Tourism will coordinate the implementation of this action plan. The implementation process will start in 2008 and will last for three years. The estimated cost is \$249 000.

#### 3.3.13 Activity: public awareness, information and education (article 10)

##### 3.3.13.1 Objectives and Priorities of the action plan

The overall objective of this action plan is to guarantee that Botswana has appropriate institutional capacity to ensure that the public is adequately aware of the POPs issues, and POPs related activities and has measurable public input regarding the implementation of the Convention.

The priorities within the action plan include building institutional capacity amongst communities to create an enabling environment for the full implementation of the convention with full participation of all stakeholders. It is only through rigorous awareness and educational campaigns that the public can be made to realize and appreciate the need for their participation. This therefore calls for necessary structures and tools to ensure that information is readily available, accessible and affordable to end users.

### **3.3.13.2 Summary of the inventory findings**

A survey on various groups of stakeholders to determine the level of public awareness on POPs, revealed that at least 74,58% of Farmers and 62,50% of the general public were not aware of POPs . However, a survey of the government employees revealed they were the most knowledgeable at 62,26%. The overall awareness on POPs stands at 43,26%.

The high percentage of awareness among government employees was however distorted as discussions with respondents on the subject matter revealed little knowledge except elaborating the acronym POPs. It was also marred by the fact that most of the respondents were environmental health officers or had science based training. The survey also revealed the efficiency of educational programmes to farmers offered by MoA , as 49,15% of farmers had access to information on safe handling of chemicals.

Furthermore the study has showed a need to build awareness amongst those that sell chemicals to the general public since many of those who did not have chemicals training background knew very little about POPs and general chemicals use. This limited knowledge creates a situation where the customers do not get the needed advice from the agent, but tend to rely mostly on the use of directions/labels for use that come with the product. In cases where the public is illiterate, this scenario poses a great danger of the chemicals not being used in a safe manner both to the environment and human health.

The major findings from the inventory exercise are that majority of the people are not aware of POPs and POPs related issues. Sometimes in cases where people have an idea about POPs, it is only a small number that have in depth knowledge or understanding of the subject. Further to this information on chemicals in general is not readily available to enable the public to make informed decisions on the use and handling of the various chemicals that are available in the market. The Ministry of Agriculture has started raising farmers' awareness on management of pesticides. This has to some extent raised the level of farmer's understanding on issues of management including chemical waste disposal principle. It has been observed that although the results from the Ministry of Agriculture's Programme point to a positive impact on the part of the farmers' understanding of pesticides management, the issue of POPs does not seem to feature prominently based on the farmer's responses.

The inventory also showed that environmental information in general is not readily available to the general public thus creating a deficiency in the environmental knowledge base amongst key stakeholders in the area of environment. Inadequate environmental awareness amongst the general public can not in any way help advance the cause of attaining sustainable development in the country.

Some POPs are useful substances that are still used to address some of the human needs such as in the case of mosquito control as a public health issue, the use of such chemicals in the building industry and the use of PCBs such as in transformers. Issues of unintentional release of POPs are some of those issues which are not addressed anywhere in the policies and legislative framework. Therefore these are some of the issues that Policies and Legislation need to take on board if the country is to effectively implement the POPs Convention.

There is need to address the issue of resource mobilization if the actions outlined in the national implementation plan are to be effectively implemented. For public awareness to be successfully carried out, information capturing and dissemination tools need to be in place. Not only should they be in place but they should also be accessible and affordable to the general public.

There are limited Policy issues relating to public information dissemination and environmental awareness in general. Where Policies or drafts exist, they do not extensively address issues of awareness and information dissemination and by extension nothing on POPs information in particular. Through the inventory exercise it has come out clearly that capacities at all levels on management of chemicals and POPs in particular are inadequate. It is therefore crucial that issues of capacity at both institutional and community levels are addressed.

### 3.3.13.3 Action plan implementation

Creating awareness among policy and decision makers is crucial for any project to succeed. Educating various stakeholders such as educators, extension personnel should be strengthened on POPs management as they are the ones that come into contact directly and indirectly and are most at risk. Information dissemination is a critical component of this exercise, therefore availability of information in both languages will enhance understanding and learning about POPs. Educating the general public can be best done using the media, incorporating POPs education into the curriculum for basic and secondary education and through various educators. Information technology such as a webpage will enable easy access of information and updates on POPs to learners and stakeholders. The action plan is detailed in Table 46.

**Table 46: Action plan to promote public awareness activities on POPs**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To create awareness among policy and decision makers on POPs by 2010	Identify relevant decision makers Organize workshops to sensitize identified groups	One month Continuous	DEA, DWMPC	Policy makers, MLG,	10 workshops @US\$ 800 each a year = US\$8000
To train workers, scientists, educators, technical and managerial personnel on POPs by 2010	Identify the various personnel Develop training plan for various groups Produce training materials for training workshops Conduct training workshops	Two months 6 months 6 months continuous	DEA, DWMPC	BPC, MoH, EH-MLG, Industries, DBES	US\$ 4000 US\$20000 US\$ 40000 US\$90 000 per year
To develop and produce IEC materials on POPs in both English and Setswana by 2010	Develop and produce awareness raising materials e.g. brochures, articles, posters, newsletters etc on POPs. Develop radio and TV education programmes/adverts Place adverts for various forms of billboards	Continuous Continuous Continuous	DEA, DWMPC,	MoA, MoH, MoE, EH-LG, MST	US\$ 100 000 per year US\$ 200 000 per year US\$60 000 per year
To develop and implement public education and awareness raising programmes by 2010	infuse POPs management in the environmental education syllabus of basic and secondary schools Provide and train the media people with information materials on POPs	1 year Continuous Continuous	DEA, DWMPC	MoE, MLG, MoH,	US\$ 30 000 US\$ 3000 US\$ 5000

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
	Identify and train resource persons to carry out public education				
To promote easy access and dissemination of environmental information by 2010	Develop webpage	1 year	DEA, DWMPC	Libraries, MoE, UB, Environmental NGO's	US \$ 50 000
	Avail and promote information dissemination on POPs through various Stakeholders ( libraries, Gov Departments, NGOs etc)	Continuous			US \$ 30 000
To create awareness among policy and decision makers on POPs by 2010	Identify relevant decision makers	One month	DEA, DWMPC	Policy makers, MLG,	10 workshops @US\$ 800 each a year = US\$8000
	Organize workshops to sensitize identified groups	Continuous			
To train workers, scientists, educators, technical and managerial personnel on POPs by 2010	Identify the various personnel	Two months	DEA, DWMPC	BPC, MoH, EH-MLG, Industries, DBES	US\$ 4000
	Develop training plan for various groups	6 months			US\$20000
	Produce training materials for training workshops	6 months			US\$ 40000
	Conduct training workshops	continuous			US\$ 90 000 per year
To train extension personnel (teachers, farmers, BURS etc) on POPs by 2010	Identify extension workers	6 months	DEA, DWMPC	MoH, BURS, Police, MoE, EH-LG, MoA, Environmental NGO's	US \$12 000
	Develop course modules specific for various extension personnel	6 months			US \$ 15 000
	Produce training materials for training workshops.	6 months			US\$ 200 000
	Organise workshops and seminars	continuous			US \$ 100 000
Coordinator – Ministry of Environment, Wildlife and Tourism (DEA, POPs focal point)					
Period - Continuous					
Total Cost - US\$700 000					

#### 3.3.13.4 Timeframe, budget and coordination

The action plan is expected to start in April 2008, since is educational it has no end. It will be coordinated by DEA and DWMPC. The cost of the project is calculated at US\$ 700 000.

#### 3.3.14 Activity: effectiveness evaluation (article 16)

Measures addressing effectiveness evaluation are addressed in chapter 3.3.15.

#### 3.3.15 Activity: reporting

##### 3.3.15.1 Objectives and priorities of the action plan

The Stockholm Convention on Persistent Organic Pollutants (POPs) requires parties to provide statistical data on use, importation, exportation and production of Annex A and B POPs chemicals. The convention further requires parties to monitor effectiveness of the strategies to

ensure reduction; elimination and restriction of Annex A, B and C POPs chemicals and conduct regular reviews of the NIP implementation and its effectiveness.

### 3.3.15.2 Summary of the inventory findings

The following table summarizes the reporting obligations of the Stockholm Convention (Table 47).

**Table 47: Reporting obligations of the Stockholm Convention**

DESCRIPTION OF REQUIREMENT	PERIODICITY
Article 5, subparagraph (a) requires each Party to develop an action plan, or, where appropriate, a regional or sub-regional action plan, and subsequently to implement it as part of its national implementation plan specified in article 7, designed to identify, characterize and address the release of the chemicals listed in Annex C of the Convention.	Within two years of the date in which the Convention enters into force for that Party
Article 5, subparagraph (a) (v) requires a review to be undertaken of those strategies pursuant to the development of an action plan to identify, characterize and address the release of the unintentionally produced persistent organic pollutants listed in Annex C, and of their success.	Every five years
Article 7 requires each Party to develop and endeavour to implement an implementation plan and transmit it to the Conference of the Parties, and requires each Party to review and update its plan on a periodic basis and in a manner to be specified in a decision of the Conference of the Parties.	Transmission to the Conference of the Parties within two years of the date on which the Convention enters into force for that Party.
Article 15 requests that each Party shall report to the Conference of the Parties on the measures it has taken to implement the provisions of the Convention and on the effectiveness of such measures in meeting the objectives of the Convention. Each Party shall provide to the Secretariat: (a) Statistical data on its total quantities of production, import and export of each of the chemicals listed in Annex A and Annex B or a reasonable estimate of such data; and (b) To the extent practicable, a list of the States from which it has imported each such substance and the States to which it has exported each such substance.	To be decided by the Conference of the Parties.
Article 16 requires an evaluation of effectiveness commencing four years after the date of entry into force of the Convention and periodically thereafter. Requires also reports and information, including the reports and monitoring information called for in paragraph 2 of article 16 (results of monitoring activities on a regional and global basis), the national reports submitted pursuant to article 15 and non-compliance information provided pursuant to the procedures to be established under article 17.	Commencing four years after the entry into force of the Convention.
Annex A, part II subparagraph (g) requires each Party to provide a report every five years on progress in eliminating polychlorinated biphenyls and submit it to the Conference of the Parties pursuant to article 15.	Every five years
Annex B, part II, paragraph 4 requests that each Party that uses DDT is required to provide to the Secretariat information on the amount used, the conditions of such use and its relevance to that Party's disease management strategy in a format to be decided by the Conference of the Parties in consultation with the World Health Organization.	Every three years

In order to comply with requirements of the convention an action plan with set objectives has been developed to monitor effectiveness of the intervention strategies. This will be achieved through submission of country reports to the POPs focal point, which will then develop effectiveness evaluation reports for country purposes as well as the necessary reports to the Secretariat.

### 3.3.15.3 Action plan implementation

To provide statistical data, to the secretariat, on Annex A and Annex B chemicals imported. An inventory of Annex A and B POPs Chemicals will be updated on annual basis. A report will be

submitted to the secretariat on 5 yearly basis. The coordinating agency is the Department of Waste Management and Pollution Control (DWMPC) in conjunction with the Department of Environmental Affairs (DEA). This is estimated to cost \$36,000 starting April, 2009.

Review strategies for the management of Annex C POPs chemicals every two years and report on these activities every two years and report these activities to the secretariat on five yearly basis. This will entail updating of the inventory and monitoring the implementation of the action plans for reduction of releases of this class of chemicals. This will be done at a cost of \$65,000, starting in April 2009.

Consolidation of NIP reports in order to submit country reports on POPs will be done every four years with DEA as the lead institution. This is estimated to cost \$10,000 starting April 2009.

To submit updated PCB inventory reports on stocks, imports, exports and disposal. This will require development, implementation and monitoring of the action plan. This will be done on five yearly intervals at an estimated cost of \$22,000.

To submit updated DDT inventory report as required by the convention (Annex B part II). This includes reporting on quantities on stocks and conditions of use for disease management strategies. This will be done every three years at a cost of \$20,000.

To ensure regular assessment of the effectiveness of the NIP implementation. The POPs focal point will prepare evaluation reports. It will entail reviewing of reports and establishment of trend analysis on POPs reduction. This will be done at an interval of three years at a cost of \$15,000.00.

The action plan on effectiveness evaluation and reporting is elaborated in Table 48.

**Table 48: Action plan on measures addressing the reporting and effectiveness evaluation of the Stockholm Convention**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To provide statistical data, to the secretariat, on Annex A and Annex B chemicals imported	<ul style="list-style-type: none"> <li>Maintain an inventory of all Annex A and Annex B chemicals imported each year</li> <li>Report on the quantities of Annex A and Annex B chemicals imported &amp; exported each year</li> <li>Conduct regular audits &amp; reporting to ensure conformity</li> <li>Submit 5yearlyreports to the secretariat through DEA</li> </ul>	Continuous	MoH - Epidemiology	Industries Utilities Local Authorities	\$5 000
		Continuous	DEA Industries Utilities Local Authorities MoH DWMPC	MoH	\$5 000
		Bi-annually /annual	Trade Statistics		\$20 000
		Bi annual			\$6 000
To submit report for Annex C POPs	<ul style="list-style-type: none"> <li>Update inventory</li> <li>Develop action plan</li> <li>Implementation of the plan</li> <li>Reporting on Annex C POPs</li> </ul>	continuous	DWMPC	Industries	\$5 000
		2 yearly interval	DEA	Utilities (BPC, WUC, BR)	\$5 000
		Continuous		Local Authorities	\$10 000
To ensure regular review of the implementatio	<ul style="list-style-type: none"> <li>Stakeholder consultation</li> <li>Update NIP</li> <li>Submission of completed</li> </ul>	5 yearly interval		MoH MoA	
		4 yearly interval	DEA	DWMPC	\$10 000
		Continuous		Industries	\$50 000
		After 4 years		Utilities (BPC, WUC, BR)	\$5 000

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
n plan	NIP report.			Local Authorities MoH	
To submit country reports on POPs.	<ul style="list-style-type: none"> <li>Consolidation of NIP reports</li> <li>Submission of country report.</li> </ul>	4 yearly interval After 4 years	DEA	DWMPC Industries Utilities (BPC, WUC, BR) Local Authorities MoH	\$5 000 \$5 000
To submit PCB reports on stocks, imports, exports and disposal thereof.	<ul style="list-style-type: none"> <li>Update inventory</li> <li>Develop action plan</li> <li>Implementation of the monitoring plan.</li> <li>Report submission</li> </ul>	Continuous 3 months Continuous 5 yearly interval	DWMPC DEA	DWMPC Industries Utilities (BPC, WUC, BR) Local Authorities MoH	\$5 000 \$2 000 \$10 000 \$5 000
To submit the DDT report as required by the convention (Annex B II)	<ul style="list-style-type: none"> <li>Update inventory</li> <li>Report on quantities and conditions of such use and the relevance to the disease management strategy.</li> <li>Report submission</li> </ul>	Continuous Continuous 3 yearly interval	MoH DEA	Community in malaria controlled areas	\$5 000 \$10 000 \$5 000
Regular assessment of the effectiveness of the NIP implementation	<ul style="list-style-type: none"> <li>Review of the reports indicated in this action plan</li> <li>Establishment of time-trend analysis on POPs reduction</li> <li>Preparation of effectiveness reports</li> </ul>	3 yearly interval	DEA	All NIP implementation stakeholders	\$15 000
Coordinator – Ministry of Environment, Wildlife and Tourism (DEA, POPs focal point)					
Period - Continuous					
Total Cost - \$ 188 000					

#### 3.3.15.4 Timeframe, budget and coordination

The Department of Environmental Affairs/ POPs focal point under the Ministry of Environment, Wildlife and Tourism will coordinate the implementation of this action plan. The implementation process is continuous from 2008. The estimated cost for five years is \$188 000.

#### 3.3.16 Activity: research, development and monitoring (article 11)

##### 3.3.16.1 Objectives and priorities of the action plan

The objectives of the action plan is to establish the effects of POPs on human health and environment, to develop research methods that identifies links between POPs exposures in the environment and health, to devise pollutant concentration models to determine the fate of POPs in the environment, and to formulate risk management strategies addressing specific group susceptibilities to POPs.

### **3.3.16.2 Summary of the inventory findings**

Research development and monitoring priorities in this plan primarily addresses the health and environmental impacts associated with improper management of POPs. The relevance of the proposed research development and monitoring in the plan relates to their intrinsic properties such as bio accumulation and persistence. The management of POPs from the time of import, when transporting to the retailers and users, handling by workers and users, storage before use and prior to disposal, management during use, and disposal is crucial if the associated problems are to be avoided. Some common problems associated with different POPs include; PCB spillages from leaking transformers, unintentional releases from industrial sources, release of dioxins and furans from improper incineration caused by incomplete combustion, unmanaged stockpiles and waste which can eventually be washed out into water sources.

Unlike other chemicals POPs are known to travel distances from point sources to reside in environmental receptors such as water sources and soil where they persist and bio accumulate. Transport processes into the environmental receptors may include wash off, leaching, wet and dry deposition and the transformation may be influenced by climatic (seasonal) variability, topography including the type of vegetation and temperatures.

Ecological receptors such as fish gather traces of these chemicals in the water courses that they leave in; eventually processes such as bio magnification in fish increases the amount of POPs in the fish bodies ultimately exposing all the elements of the food chain to the chemicals. Exposure to people is often indirect through consumption of the contaminated fish. However it is imperative that a research be formulated to establish the potential risks to human population groups such as children, women of reproductive age and farmers. Other risk studies may involve assessment of workers who have worked with the equipment for sometime. The challenges associated with the improper management of POPs addressed in different annexure of the POPs Convention calls for promotion of research activities that can impart knowledge on their sources and releases into the environment, their concentrations and in humans and environment, and fate in the environment. This can lead to interventions aimed at release, reduction and elimination which can inform the strategy and activities associated with their proper management and best environmental practices in POPs management.

### **3.3.16.3 Action plan implementation**

The proposed research areas in the implementation plan covers areas concerned with human health and environmental protection covering a period of up to five years (2008 – 2012). The proposed methods such as establishing potential risk incurred from occupational exposure and ecological risk assessments are the current areas that need attention by researchers. The use of models to establish the fate of dioxins and furans illustrates the current scientific methods for determining the processes and changes that determine the indirect health effects of POPs from environmental and ecological receptors. These can facilitate knowledge base on the associated toxicity effects to humans.

Incineration of medical waste in Botswana has contributed to release of dioxins and furans due to improper operation thus causing incomplete combustion. The problem is still continuing as there is still inadequate scientific knowledge on their transport and transformation which determines their fate. Therefore it is difficult to convince the policy makers on proper incineration practices or alternative technologies. With the high prevalence of AIDS/HIV and high hospital bed admission rates, the rise in quantities of medical waste requires the use of incinerators as the available technologies. The plan is to carry out the study in the 2008/2009 financial year using the Princess Marina Hospital incinerator. Ministry of Health with department of waste management and Pollution Control will be the lead institutions in this study.

Other suggested research methods involve measuring the concentration of agro chemicals in the tissues of bodies of exposed population with emphasis on susceptible groups such as children and farmers. The studies seek to answer the question of direct exposure in occupational groups. Both studies will be conducted in the period of 2009 – 2010 and 2011 – 2012 respectively. Pesticide use in Botswana is vast as one of the pillars of the economy is based on agriculture. Subsistence agriculture is also common amongst families. Therefore agro chemicals exposure can not be overlooked.

The proper management of use of POPs by industry is another area that is of concern when looking at the health and environmental impacts of the chemicals. As the country's economy continues to rise and a lot of industries are coming up mainly the mining and energy sector; the challenge is for the government to gear up the measures to control the import and properly manage the use of these chemicals. Continued exposure to workers due to inadequate intervention programmes continues to pose a risk of exposure to the workers. Though at the time of this plan there has not been enough evidence related to workers risks or there is no established research on PCB's studies and associated risks. Therefore this plan proposes a risk based study on exposure to PCB's for the years 2010 -2011.

The action plan on research and development is elaborated in Table 49.

**Table 49: Action plan to facilitate research and development**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
To investigate the fate of dioxins and furans from sources of incomplete combustions with emphasis on medical waste incineration by March 2009	• Use of the available data on sources of dioxins and furans – (inventories)	04/08 – 04/08	MOH DWMPC	MOH LA's DEA WHO	\$5 000
	• Train researchers on modelling of the air contaminant	04/08 – 05/08			
	• Model transportation & transformation to determine the fate of dioxins and furans in the environment(direct exposure)	05/08 – 07/08			
	• Establish the human health effects(indirect exposure) from modelling data	07/08 – 09/08			
	• Disseminate information to inform best practices in incineration processes.	10/08 – 12/08			<b>\$5 000</b>
To conduct a bio monitoring study to establish effects of exposure of insecticides to children and women of reproductive age by March 2009	• Explore potential partners (Bilateral )	04/08 - 12/08	MOA MOH	UNFPA WHO	\$1 000
	• Establish networks for sample analysis / bio monitoring(regional)	04/08 – 07/08	LA's DEA MRC(SA)	UNEP UNICEF ILO	\$1 000 \$20 000
	• Develop local expertise for exposure analysis studies	08 /08 – 10/08	Farmers Associations	MRC(SA)	
	• Carry out the research	09/08 – 02/09	BOTEC	UB BOTEC	\$10 000 \$5 000
	• Develop risk based strategy for management of exposure to agricultural pesticides.	02/09 – 04/09	UB		

					<b>\$37 000</b>
To investigate the neurological effects amongst farm workers exposed to pesticides by March 2010	• Explore potential funding partners - Bilateral	02/09 - 06/09	MOH	WHO	\$1 000
	• Establish networks for sample analysis(Bio Monitoring)	04/09 – 05/09	MOA UB LA's DEA	UNEP ILO UB MRC(SA)	\$1 000
	• Develop local expertise for exposure analysis studies	04 /08 – 08/08	Farmers Associations		\$20 000
	• Carry out the research	09/08 – 02/09	Workers Unions		\$10 000
	• Develop risk based strategy for management of exposure to agricultural pesticides to farm workers.	02/09 – 04/09	MRC( SA)		\$5 000
					<b>\$37 000</b>
To conduct a risk assessment study on workers potentially exposed to PCB's by March 2011.	• Risk identification in industries	02 /10 – 03/10	MOH	WHO / IPCS	\$2 000
	• Explore potential funding partners - Bilateral	02 /10 – 06/10	LA's DEA	UNEP UNICEF	\$1 000
	• Training of researchers : risk assessments methodologies & workplace exposure monitoring	06/10 – 07/10	Workers Unions Industry (Users)	ILO UNIDO Workers Unions	\$20 000
	• Monitoring of potential personal exposure to PCB's	07/10 – 12/10			\$7 000
	• Risk Assessment using monitoring data	01/10 – 02/10			\$1 000
	• Risk Analysis	02/10 – 03/10			\$1000
	• Risk Communication				\$6000
					<b>\$38000</b>
To carry out an ecological risk assessment for fish contaminated with PCB's - Potential exposure to fish consumers by March 2012	• Risk identification	04/12 – 06/12	MOH	WHO	\$4 000
	• Explore potential partners (Bilateral)	04/12 – 05/12	MOA	UNEP UB/ Biological Science FAO	\$1 000
	• Training of researchers on ecological risk assessments methodologies	05/12 – 05/12	Fisheries/(D WNP) Plant Protection Agric Research LA's DEA		\$12 000
	• Measuring quantities of PCB's in fish	05/12 – 07/12			\$2 000
	• Risk Assessment using monitoring data	07/12 – 09/12			\$1 000
	• Risk Analysis	10/12 – 12/12			\$1 000
• Risk Communication					
					<b>\$22 000</b>

#### 3.3.16.4 Timeframe, budget and coordination

The Department of Environmental Affairs under the Ministry of Environment, Wildlife and Tourism will coordinate the implementation of this action plan. The implementation will start in 2008 and will last for five years. The total budget is estimated at \$139 000.

#### 3.3.17 Activity: Technical and financial assistance (articles 12 and 13)

##### 3.3.17.1 Objectives and priorities of the action plan

Article 12 and 13 makes provision to facilitate access to technical and financial resources from regional and international donors. This support will assist in augmenting efforts made by government to build capacity to enable the country to implement obligations under the

convention. The objective of the action plan is to identify sources of financial and technical assistance, and facilitate access to such.

### 3.3.17.2 Action plan implementation

Although Botswana is considered as an economy in transition, there are still a lot of gaps and challenges that are faced by the country in terms of human, financial, legal and infrastructural capacity. Botswana has limited human resources and technical infrastructure to manage and dispose hazardous waste. The current landfills for instance do not provide for treatment and incineration of hazardous waste, some provide temporary storage before exported to countries with the capability to handle these. Research and environmental monitoring is also limited, bio monitoring, assessment of effects of POPs and or hazardous substances on human health and risk assessments are areas that need to be augmented financially and technically. Awareness raising and most especially enforcement of legislation is also lacking. These areas should be given attention in technical and financial assistance. The action plan is shown in Table 50.

**Table 50: Action plan on technical and financial assistance**

Objective	Activities	Timeframe	Responsible institution	Stakeholders	Cost
Develop strategies to access financial resources from regional and international organisations by May 2008	<ul style="list-style-type: none"> <li>Identify sources of funds</li> <li>Inform interested parties, including civil society and facilitate access to funds</li> <li>Make a requisition for financial assistance</li> </ul>	Continuous	DEA	MOA, DWMPC, MOH, MFDP, UNEP, UNIDO, SADC	\$3 400 per annum
Collaborate with international/regional organisation to build capacity in POPs July 2008	<ul style="list-style-type: none"> <li>Identify technical and training needs</li> <li>Make a requisition for technical support</li> <li>Promote and facilitate benchmarking and networking</li> </ul>	Continuous	DEA	MOA, DWMPC, MOH, UNEP, UNIDO, SADC  MOA, DWMPC, MOH, NGOs, UNIDO	\$10 000 per annum

### 3.3.17.3 Timeframe, budget and coordination

The Department of Environmental Affairs in the Ministry of Environment, Wildlife and Tourism will coordinate the implementation of this action plan. The implementation will start in May 2008 and is a continuous process. The total budget is estimated at \$13 400 per year, so a period of six years (until 2013) it be \$80 400.

## 3.4 DEVELOPMENT OF CAPACITY BUILDING PROPOSALS AND PRIORITIES

### 3.4.1.1 Capacity building priorities

Capacity building priorities refer to the POPs convention action plan activities which are intended to achieve compliance to the Stockholm Convention in Botswana. These priorities are in no particular order. However, providing training to key stakeholders is considered paramount. This will ensure knowledge transfer which will facilitate the implementation and conformance to the

Stockholm Convention. The other important priority is the review and harmonisation of enabling legislative framework. Achievement of these priorities will ensure that Botswana meets the set deadlines for POPs elimination.

Below is a list of Capacity Building Priorities in no particular order.

- a) Training personnel to implement the provisions of the convention.
- b) Build capacity at BURS to effectively control POPs import and export.
- c) Strengthen existing capacity for POPs analysis.
- d) Build capacity on stakeholder institutions so that they can provide information on POPs to the users (linked with information centre in the action plan 3.3.13) and conduct training workshops for stake holders.
- e) Provide training for field assistants on data collection.
- f) Reassemble regional teams and compilation of inventory.
- g) Gap analysis/ identification, benchmarking and development of strategies
- h) Train workers in the use and handling of POPs chemicals and raise awareness in the affected house holds.
- i) Training of the inspectors and laboratory personnel.
- j) Revision of existing incinerator guidelines based on BAT and BEP
- k) Train and upgrade skills of personnel in the management of contaminated sites.
- l) Resuscitation of the POPs committee and development of its mandate in relation to NIP implementation.
- m) Establishment of network of experts including NGOs (national and international) to facilitate information exchange on POPs.
- n) Develop and produce awareness raising materials e.g. brochures, articles posters, newsletters, TV education and billboards.
- o) Infuse POPs management in the environmental education syllabus of basic and secondary schools.
- p) Train researchers on the modelling of air contaminants.
- q) Revise environmental legal framework to incorporate regulation on POPs.
- r) Undertake wider stakeholder consultation on harmonisation of sectoral environmental laws.
- s) Include POPs related priorities into the NDP 10/ DDP 7/ UDP 3.
- t) Register all chemicals intended for production use importation and exportation in Botswana.
- u) Provide health services at the point of entry for POPs chemicals.
- v) Consult stakeholders for resource availability, procure test kits and conduct quantitative analysis.
- w) Draft policies to AGs for review then pass to parliament for approval.

#### **3.4.1.2 Investment priorities**

Investment priorities refer to the POPs convention action plan activities which augment capacity building initiatives to achieve compliance to the Stockholm Convention in Botswana. These priorities are in no particular order. However, establishment of structures such as inspectorate unit is recommended to monitor compliance and as well as ensure regular stakeholder consultations. The need to procure test equipment, awareness creation, regular monitoring of imports and exports, licensing of chemical dealers, establishment and enforcement of safety standards and presentation of reports to the conference of parties will facilitate the implementation and conformance to the Stockholm Convention deadlines.

Below is a list of investment priorities in no particular order.

- i. Establishment of an inspectorate unit within DWMPC to monitor the import and usage of POPs.
- ii. Develop educational training materials on POPs chemicals.
- iii. Inventorise all Annex A, B and C POPs chemicals both imported and in stock, obsolete POPs chemicals, empty containers and create a data base.
- iv. Development of procedures to address the management of empty containers, obsolete insecticides and incorporation of procedures into the DDT spraying training program
- v. Put in place measures to ensure appropriate management of POPs pesticides.
- vi. Export all the collected waste for disposal.
- vii. License all chemical dealers.
- viii. Carryout inspections for compliance.
- ix. Implementation and monitoring of POPs.
- x. Determine extent of contamination, development of appropriate management plans/guidelines for containment and rehabilitation exercise.
- xi. Secure and label site having stockpiles and waste to prevent releases from spreading, identifying remediation technologies and monitor surface and ground water.
- xii. Provision of appropriate PPE, provision of safety measures on POPs and monitoring usage of PPE.
- xiii. Land acquisition, securing of funds, and construction of storage facility and procurement of equipment.
- xiv. Inform WHO and the secretariat to continue the use of DDT, procure required quantities of DDT and continue to look for alternatives.
- xv. Develop an appropriate reporting format in line with the convention and the strategy/approach for preparing regular reports to the COP.
- xvi. Revise guidelines for handling and use, establish the extent of DDT use in other sectors and monitor usage.
- xvii. Ensure weekly notifications from the districts on malaria incidents and compile reports.
- xviii. Acquisition of insecticides susceptibility and bio-assay test kits, conducting the test, assessing the malaria vector dynamics and submit report to the secretariat.
- xix. Development and implementation of appropriate safety program on Annex C POPs.
- xx. Development of emission factors, provide monitoring levels/standards and set limit values for POPs.
- xxi. Identify and device a strategy of dealing and reporting on cross cutting issues between POPs and related conventions (synergies).
- xxii. Create nodes to the environment information system (EIS) within all NIP implementation agencies.
- xxiii. Regularly update the website on POPs issues by the NIP implementation agencies.
- xxiv. Regular meeting and/or work shops among the NIP implementation agencies.
- xxv. Identify relevant decision makers and organise workshops to sensitise the identified groups.
- xxvi. Submit 5 year reports to the secretariat and conduct regular audits and reporting to ensure conformity.
- xxvii. Submit completed reports on POPs, i.e. NIP, country reports, quantities and conditions of use.
- xxviii. Use of the available data on sources of dioxins and furans, and model transportation to determine the fate of dioxins and furans in the environment as well as health effects.
- xxix. Establish networks for sample analysis and for bio-monitoring.
- xxx. Explore potential funding partners.
- xxxi. Monitoring of potential personal exposure to PCBs.

### 3.5 TIMETABLE FOR PLAN IMPLEMENTATION AND MEASURES OF SUCCESS

Timetable for the NIP implementation is summarized together with resource requirements and is elaborated under chapter 3.6

### 3.6 RESOURCE REQUIREMENTS

Resource requirements are elaborated in Table 51. Values in the table are provided in thousand US\$. Values also represent the timetable for the implementation. The process will start in 2008 and encompasses 6 years; up to 2013. The total NIP implementation is estimated to be 10.1 million US\$, which does not include the cost of disposal of PCBs.

**Table 51: Timetable and resource requirements for NIP implementation**

<b>ACTION PLAN</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>Budget US\$</b>
3.3.1 institutional and regulatory changes		349.0	73.0				<b>422.0</b>
3.3.3 measures to address Annex A Part I POPs Chemicals		413.4	413.4	413.4	413.4	413.4	<b>2,067.0</b>
3.3.4 measures to address Annex A Part II Chemicals		391.0	391.0	391.0	391.0	391.0	<b>1,955.0</b>
3.3.5 measures to address Annex B Chemicals		310.0	266.0	246.0	246.0	146.0	<b>1,214.0</b>
3.3.7 measures to reduce releases from unintentional production		166.6	166.6	166.6	166.6	166.6	<b>833.0</b>
3.3.11 measures to identify and manage POPs contaminated sites		670.0	100.0				<b>770.0</b>
3.3.12 facilitate information exchange			186.0	68.0			<b>254.0</b>
3.3.13 promote public awareness activities on POPs		1,023.0	585.0				<b>1,608.0</b>
3.3.15 measures addressing reporting and effectiveness evaluation of Stockholm Convention		37.6	37.6	37.6	37.6	37.6	<b>188.0</b>
3.3.16 facilitate research and development	47.0	32.0	38.0	11.0	11.0		<b>139.0</b>
3.3.17 technical and financial assistance	13.4	13.4	13.4	13.4	13.4	13.4	<b>80.4</b>
coordination of the NIP implementation		114.0	114.0	114.0	114.0	114.0	<b>570.0</b>
<b>Total budget:</b>	<b>60.4</b>	<b>3,520.0</b>	<b>2,384.0</b>	<b>1,461.0</b>	<b>1,393.0</b>	<b>1,282.0</b>	<b>10,100.4</b>



## ANNEX I: COPY OF THE ENDORSEMENT LETTERS